



Class SF911

Book .W95

Copyright N^o _____

COPYRIGHT DEPOSIT.



CATECHISM

OF THE

Principles of Veterinary Surgery

BY

W. E. A. WYMAN, M.D.V., V.S.

AUTHOR OF "THE CLINICAL DIAGNOSIS OF LAMENESS IN THE HORSE,"

"TIBIO-PERONEAL NEURECTOMY," TRANSLATOR OF

DE BRUIN'S "BOVINE OBSTETRICS," ETC.



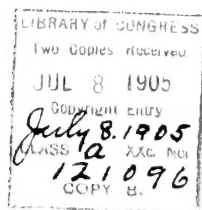
NEW YORK

WILLIAM R. JENKINS

VETERINARY PUBLISHER AND BOOKSELLER

851 AND 853 SIXTH AVENUE

1905



Copyright, 1905, by WILLIAM R. JENKINS

All rights reserved

PRINTED BY THE
PRESS OF WILLIAM R. JENKINS

PREFACE.

NOBODY can diagnose, treat and prognose a surgical case intelligently unless thoroughly acquainted with the scientific principles involved in any particular case. The student is obliged to gain his knowledge of the various surgical "ologies" by lectures, and after all by the perusal and study of works written for the human practitioner. The former is insufficient and the latter obviously wrong.

The principles applicable to human surgery and those of veterinary surgery, while in a great many instances closely related, nevertheless differ materially. For instance, asepsis, a condition *sine qua non* to the human surgeon, as a rule exists in veterinary surgery only in theory, although lately some of the leading surgeons in human surgery lean strongly toward antisepsis. In human surgery, periostitis plays an unimportant rôle, while it is of vital importance to the equine practitioner. Notice the difference in the prognosis and treatment of fractures. How many human surgeons apply the firing iron and blisters? This work is purely for the veterinarian. As a former teacher of veterinary students, I am fairly conversant with their needs. It has been my most earnest desire and effort to supply a work which, while scientific and modern, is free from matters of doubtful interest to the American student.

The student requires a work which explains ; it is for this reason that I wrote this work in questions and answers. Depending on the importance of the subject from a practical standpoint, a more or less exhaustive discussion has been indulged in, exemplified by every-day cases.

Occasionally the therapeutic part of this work has become a little more extensive than probably permissible in a work on the Principles of Surgery. The only apology which I offer, if such is necessary, consists in the desire to supply the student with certain reliable facts which he cannot find in print elsewhere.

In arranging and classifying the various subjects, I followed Prof. Dr. Eug. Fröhner's masterly exhibition on General Surgery, which Prof. Fröhner kindly permitted me to do and for which I herewith extend my best thanks.

Illustrations are omitted, as the clinic, the histological, pathological and anatomical laboratories should supply the student with the real thing.

W. E. A. WYMAN.

CONTENTS.

| | PAGE |
|--|------|
| GENERAL SURGERY..... | 1 |
| ARREST OF HEMORRHAGE..... | 7 |
| THE HEALING OF WOUNDS..... | 13 |
| ABNORMAL GRANULATIONS AND CICATRIZATION..... | 17 |
| REGENERATION OF THE VARIOUS TISSUES..... | 19 |
| TRAUMATIC INFECTIOUS DISEASES..... | 21 |
| SUPPURATION OF WOUNDS..... | 21 |
| CELLULITIS..... | 23 |
| TRAUMATIC FEVER..... | 28 |
| SEPTICÆMIA..... | 29 |
| PYÆMIA..... | 32 |
| SPECIFIC TRAUMATIC INFECTIOUS DISEASES..... | 34 |
| Malignant Œdema..... | 34 |
| Tetanus..... | 35 |
| THE TREATMENT OF WOUNDS..... | 39 |
| THE TREATMENT OF SPECIFIC WOUNDS..... | 43 |
| CONTUSIONS..... | 47 |
| SUBCUTANEOUS RUPTURES..... | 52 |
| Ruptures of Muscles..... | 52 |
| Ruptures of Tendons..... | 53 |
| INFLAMMATION..... | 55 |
| Causes..... | 56 |
| Varieties..... | 57 |
| Symptoms | 59 |
| Course and Termination..... | 60 |
| Treatment..... | 62 |
| ABSCCESS..... | 69 |

| | PAGE |
|-------------------------------------|------|
| ULCER..... | 73 |
| FISTULA..... | 77 |
| GANGRENE..... | 81 |
| TUMORS..... | 86 |
| Connective Tissue Tumors..... | 90 |
| Fatty Tumors..... | 95 |
| Mucous Tumors..... | 96 |
| Cartilaginous Tumors..... | 98 |
| Osseous Tumors..... | 99 |
| Muscular Tumors..... | 99 |
| Nerve Tumors..... | 100 |
| Vascular Tumors..... | 102 |
| Lymphatic Gland Tumors..... | 103 |
| Sarcoma..... | 104 |
| Carcinoma..... | 108 |
| Papilloma..... | 115 |
| Adenomata..... | 117 |
| Cysts..... | 118 |
| Actinomycoma..... | 121 |
| Botryomycoma..... | 125 |
| TUBERCULOSIS..... | 128 |
| CONCRETIONS AND FOREIGN BODIES..... | 132 |
| HERNIA AND PROLAPSUS..... | 141 |
| DISEASES OF BONES..... | 151 |
| Fractures..... | 151 |
| Inflammation..... | 178 |
| Periostitis..... | 179 |
| Osteomyelitis..... | 184 |
| Necrosis..... | 185 |
| Atrophy..... | 189 |
| Hypertrophy..... | 190 |
| Rachitis (Rickets)..... | 191 |
| Osteomalacia..... | 192 |

CONTENTS

vii

| | PAGE |
|--|------|
| DISEASES OF ARTICULATIONS..... | 195 |
| Arthritis..... | 195 |
| Luxation..... | 205 |
| Distortion..... | 209 |
| Contusion..... | 212 |
| Anchylosis..... | 213 |
| Contracture..... | 215 |
| Loose Bodies in the Joint..... | 217 |
| DISEASES OF TENDONS..... | 219 |
| Tendinitis..... | 219 |
| Rupture..... | 225 |
| Necrosis..... | 228 |
| DISEASES OF SYNOVIAL SHEATHS OF TENDONS..... | 230 |
| Inflammation..... | 230 |
| Galls..... | 232 |
| DISEASES OF THE MUCOUS BURSA..... | 236 |
| Bursitis..... | 236 |
| Dropsy..... | 238 |
| Myositis..... | 239 |
| Rupture..... | 246 |
| Atrophy..... | 248 |
| DISEASES OF APONEUROSSES..... | 51 |
| DISEASES OF NERVES..... | 254 |
| DISEASES OF ARTERIES..... | 262 |
| Arteritis..... | 262 |
| Aneurism..... | 264 |
| Rupture..... | 268 |
| DISEASES OF VEINS..... | 270 |
| Phlebitis..... | 270 |
| Varix..... | 272 |
| DISEASES OF LYMPH VESSELS..... | 273 |
| Lymphangitis..... | 273 |
| Lymphangiectasis..... | 276 |

| | PAGE |
|-----------------------------------|------|
| DISEASES OF GLANDS... .. | 276 |
| Lymphadenitis..... | 276 |
| Mammitis—Mastitis..... | 279 |
| DISEASES OF THE SKIN..... | 286 |
| Dermatitis..... | 286 |
| Burns and Scalds..... | 293 |
| DISEASES OF MUCOUS MEMBRANES..... | 300 |
| DISEASES OF THE SUBCUTIS..... | 301 |
| Edema..... | 301 |
| Emphysema..... | 303 |
| CONGENITAL MALFORMATIONS..... | 305 |

PRINCIPLES OF VETERINARY SURGERY.

GENERAL SURGERY.

Define a wound.

A breach of continuity of the skin and mucous membrane by sudden mechanical force.

What two headings may wounds be classed under?

1. Open wounds, where the break in the surface is about equal in extent to the deeper injury.

2. Subcutaneous wounds, where the break in the skin is either wanting or very limited as compared with the deeper lesions.

Depending on the cause, what kinds of open wounds are recognized?

(1) Incised or clean cut; (2) punctured or pierced; (3) lacerated or torn; (4) contused or bruised; (5) gunshot or punctured-lacerated-contused.

What qualitative classification of wounds may be made?

Simple and complicated, flap wounds, clean, dirty (dust, shavings), infected, poisoned, deep, perforating and superficial, fresh and bleeding, old granulating and suppurating wounds.

According to the seat of tissues involved, what wounds are recognized?

Abdominal, thoracic, cervical, etc.; muscular, bony, corneal, intestinal, skin wounds, etc.

Name the most important general symptoms of a fresh wound?

Hemorrhage, retraction of the edges (gaping), pain, disturbed function, systemic disturbance.

To what is the pain in a fresh wound due?

The so-called primary wound pain, which must be differentiated from the secondary wound pain setting in later on and due to inflammatory changes, depends on the cutting and tearing of sensitive nerve fibres, and the richer the injured part is endowed with nerves the greater the pain.

Are the wounds of all tissues equally painful?

Injury of the cranial contents, bones, cartilage, tendons and connective tissue are less painful than wounds of the cornea, periosteum, skin, mucous membrane (especially marked when the cutting agent is dull and its action delayed).

To what extent do the various animals react to pain?

There is a great difference, depending on the age, sex, breed, species and temperament. Dogs are more sensitive than horses, and these more so than the ox. The individual disposition also plays an important rôle. Thus some horses can be fired without reacting perceptibly while others plunge about violently.

What kind of hemorrhages are met with in wounds?

1. Arterial hemorrhage: the bright red blood appears in jets synchronously with the pulse beat.

2. Venous hemorrhage : dark-red blood in a continuous stream flows from the vessel.

3. Parenchymatous hemorrhage : this is a mixed hemorrhage, as arteries and veins of small calibre are cut, the blood drips from the wound about in the same manner as water would from a sponge, and is of dark-red color.

4. Capillary hemorrhage : the blood drips in small drops from light wounds of the skin and mucous membrane, the capillary blood-vessels being cut.

What else besides blood may flow from wounds ?

In case a large lymph vessel is cut, *lymph*; injury to articulations and tendon sheaths, *synovia*; injury of salivary glands, stenosis duct and œsophagus, *saliva*; injury to stomach, *food*; injury to intestines, *feces*; injury of udder, *milk*; injury of bladder and urethra, *urine*.

What is understood by gaping of the wound ?

Tissues possessing more or less elasticity, the edges of a wound retract. The amount of gaping depends on the nature of the cut tissues and the direction of the wound; thus wounds cutting across the fibres of muscles or tendons, or where the skin is especially tense, gape most.

What is understood by disturbed function ?

The part wounded suffers more or less loss of function. Wounds of the hoof, tendons, articulations, muscles, cause lameness; those of the cornea disturb sight; those of the tongue interfere with feeding.

To what extent do wounds influence the general health ?

Very painful wounds depress the animal to such an extent that it refuses food, more noticeable in the horse and

dog. True shock as seen in man (vasomotor paresis, the blood accumulating in the abdominal vessels; shallow respiration; weak, compressible pulse; clammy, profusely perspiring skin; absence of mental originating power) is rarely met with in animals; while following serious loss of blood pale mucous membranes, weak pulse, depression, etc. (anæmia), are observed. Occasionally sudden death follows the aspiration of air from an injured jugular vein, death being explained by air embolism of the pulmonary capillaries, filling of the cavities of the heart with air or air embolism of the capillary vessels of the brain.

What two forms of traumatic fever may produce systemic disturbances?

1. Aseptic wound fever: here a slight rise of temperature without detectable systemic disturbance follows the absorption of pyrogenous material from the wound.

2. Septic fever. High temperature and decided systemic disturbance due to the entrance of some specific infectious material into the wound and later into the general circulation.

How would you describe any wound?

(1) Region of the body (neck, thorax, leg, etc.); (2) length, width, depth, shape, direction; (3) edges of the wound (sharp, lacerated, flap, swollen, inverted, etc.); (4) secretion: odor, quantity, consistency, color; (5) by palpation with finger or probe the presence of foreign bodies and depth are learned. Fresh and deep wounds of the articulations, abdominal, cranial and thoracic cavities, tendon sheaths, and those where deep and serious hemorrhage was arrested, should not be probed.

Describe incised wounds.

Cause—Sharp cutting instrument, as surgeon's knife, glass, pieces of tin, sabre.

Characteristics—Straight, oblong shape, gape widely, as a rule bleed freely, clean cut edge; according to depth, they are tendinous, muscular, bony or skin wounds.

Prognosis—Favorable in skin wounds, otherwise the question of economy, the amount and kind of tissue destroyed, must be decisive.

Describe punctured wounds.

Causes—Pointed instruments, as dung forks, nails, needles, harrow teeth, splinters, bayonet, trocar, hypodermic needle.

Characteristics—Small roundish opening, leading into a canal of more or less depth, with limited hemorrhage unless a larger vessel has been pierced; they may be perforating and communicate with a joint, tendon sheath, abdominal or thoracic cavity, etc.

Prognosis—Surgically clean instrument, even when causing a perforating wound, entitles to a favorable prognosis, while the introduction of septic material, as by manure forks, nails, etc., may lead to fatal complications. Punctured wounds of the hoof may be followed by tetanus, while this form of injury of the softer tissues may in turn produce septic cellulitis, septicæmia, pyæmia, etc.

Describe lacerated wounds.

Causes—Tearing of tissues by nails, hooks, caulks, etc.

Characteristics—Slight hemorrhage, moderate gaping; edges may be smooth or lacerated; frequently a flap wound and then usually an angular tear.

Prognosis—Depends on the part involved and extent of the lesion. Since there is more or less tendency to necrosis, this fact must be borne in mind in making a prognosis.

What part of the body is often involved ?

In the horse, the eyelids, croup, breast and hind legs and false nostril ; in the dog, the cornea when fighting with cats.

Describe contused wounds.

Causes—The action of a blunt instrument, as kicks, falls, running against unyielding objects, coronary caulks, lying for some time on hard and rough ground ; rope burns.

Characteristics—When of a superficial nature the upper layers of the skin only are removed : abrasion, excoriation. Deep contused wounds exhibit little or no bleeding, as the separation of the intima and media from the adventitia of the bleeding vessel closes the lumen of the vessel on the same principle that the emasculator or ecraseur prevents bleeding. The edges are irregular, discolored, feel cold ; the neighborhood is swollen ; the wound contains partially detached tissue and bloodclots.

Prognosis—There is always sloughing, and the prognosis is based to a great extent upon the possibility of securing perfect drainage and thus preventing septic infection.

To what class of wounds do those created by the teeth of animals belong ?

The bites of dogs and cats are more common than those of the horse or ox. Such wounds are either punctured, contused or lacerated, or a combination of the above. Dog bites quite often cause complicated fractures.

Describe gunshot wounds.

Cause—Projectiles, as buck and bird shot, pistol and rifle balls.

Characteristics—It is a contused, lacerated wound ; there is a wound of entrance and possibly a wound of exit. The wound of entrance is smaller than the ball, because the skin is stretched as the ball hits it ; should it be larger than the ball, a foreign body has been carried in with it. With the shot fired close to the animal, the hair is singed by the powder ; when the ball grazes the surface a friction burn results. The wound of entrance has either smooth, frizzled or lacerated and depressed edges. Hemorrhage is wanting unless a larger vessel has been cut. The wound of exit is larger than the ball, irregular and everted.

Prognosis—Unless septic material has been carried in by the missile, the probe or the surgeon's finger, or vital parts destroyed or injured so as to interfere with the future usefulness of the animal, the prognosis is good.

Which animals are most exposed to gunshot wounds ?

In times of war, the horse ; during hunting seasons, all domestic animals get their share ; otherwise, hunting-dogs and cats.

Define poisoned wounds.

Wounds in which a poison has been introduced, as by snake-bite, bee or wasp sting, or which have been infected by glanders, rabies, anthrax, tetanus.

ARREST OF HEMORRHAGE.

How is bleeding stopped ?

(1) Spontaneously ; (2) artificially.

How does spontaneous arrest of hemorrhage take place ?

It is mostly seen in capillary, parenchymatous hemorrhage and when small veins are cut ; a clot (thrombus)

forms, also retraction and contraction of the cut end of the vessel. When a large blood-vessel is cut, spontaneous arrest of hemorrhage is due to retraction and contraction and thrombus formation at the cut end plus enfeebled heart action and changed composition of the blood.

Why does spontaneous arrest of hemorrhage in small vessels readily occur?

Because blood pressure is very limited in capillaries and small veins, thus favoring the formation of a clot (thrombus).

How does the changed composition of the blood following serious bleeding encourage clot formation?

The changed composition of the blood mainly consists in a decided increase of the white blood cells, by which its coagulability is greatly increased.

How much blood may an animal lose before succumbing to fatal cardiac or cerebral syncope?

Not over one-third of the total amount of blood.

How quickly does the blood regenerate after a hemorrhage?

The quantity of the blood is quite speedily replaced by resorption of the lymph of the tissues and the liquids of the stomach and intestines; the quality of the blood is at first very watery, regeneration of the red blood cells being a slow process.

How is a thrombus formed?

There are two kinds, the white and the red thrombus. The former is met with in the healthy animal, the latter is seen in septic states. At the same time both may exist together, and the thrombus is then termed a mixed thrombus.

The white thrombus is formed by the white blood cells and Bizzozero's blood plaques, and is, so to speak, a physiological product and not a coagulum. The red thrombus is a pathological product, consisting of a fibrin constituted coagulum plus red blood cells met with in the vessels of animals suffering with septic disease.

What becomes of the white thrombus ?

When aseptic, it organizes ; when infected, it softens and breaks up into emboli.

What is understood by organization of a thrombus ?

Its replacement by connective tissue. The new connective tissue formed results from proliferation of the endothelial cells of the vessel ; the thrombus itself only plays a passive rôle. The endothelial cells of the intima of the vessel take on a spindle shaped and multiform character, advance, perforate and surround the thrombus, developing later into fibrillar connective tissue cells, thus replacing the thrombus by connective tissue ; while this occurs new blood vessels are formed from the vasa vasorum. This is termed the vascularization of the thrombus.

How much time is consumed in the process of organization and vascularization ?

About four weeks.

What else may become of a thrombus ?

It may calcify and form a phlebolit (vein stone).

How is the circulation interrupted by the thrombus re-established ?

A collateral circulation forms. The vasa vasorum become larger and the central and peripheral arterial branches of the thrombus meet.

What is understood by softening of the thrombus ?

When bacteria invade a thrombus it becomes infected and breaks up into little particles (emboli), which on entering the general circulation cause a general infection of the body (pyæmia).

Define artificial arrest of hemorrhage.

The application of means which encourage coagulation or close the bleeding vessel.

How do you check hemorrhage ?

(1) By ligation; (2) compression; (3) torsion; (4) cautery; (5) heat; (6) cold; (7) remedial agents; (8) constitutional treatment.

How is hemorrhage arrested by ligation ?

It is the only safe means when large arteries or veins are cut. If possible, grasp the bleeding vessel with the artery forceps, draw it out of the wound, isolate it from the surrounding tissue, and with a surgical knot tie both extremities of the vessel. When tying this knot, do not tie the second one too tight, as it loosens the first one. If the bleeding vessel cannot be caught, it may be necessary to cut down onto it, or the less desirable method of carrying a curved needle underneath the vessel and tying it and all the tissues enclosed by the ligature. Avoid tying in a nerve. At times for anatomical reasons the bleeding vessel ought not to be ligated at its cut end, but *ligation in continuity* is indicated, as, for instance, injury of the internal carotid requires ligation of the carotid artery, or injury to the interosseous artery demands tying of the radial artery.

What material is used to ligate bleeding vessels ?

Aseptic silk or catgut.

How do you check hemorrhage by compression ?

It is employed in capillary and parenchymatous bleeding and when small vessels are cut. An exception to this rule is made in very dangerous hemorrhages, when the course of the vessel is either compressed with the finger (digital compression), or anything which is readily accessible is temporarily crowded into the wound to compress the vessel. In these cases, when possible, a string or rope, cloth, etc., is tightly wound around the parts to constrict the whole member until other means can be employed, as far as possible observing antisepsis.

What material is used to compress the bleeding parts ?

Sterilized oakum, absorbent cotton, bandages.

What is torsion and how does it act as a hemostatic ?

It consists in seizing the vessel with an artery forceps and twisting it six to eight times ; as a rule, it is used only in smaller vessels. By twisting the vessel around its own axis the intima and media become detached and curl up, while the adventitia becomes twisted ; the lumen of the vessel thus becoming smaller or closed.

How does the actual cautery act as a hemostatic ?

In smaller vessels the mere radiation of the dull-red cautery causes coagulation, while an eschar is formed when the cautery touches the bleeding end. It is mainly employed in parenchymatous bleeding and hemorrhage from smaller vessels.

Why is the actual cautery not a safe hemostatic in case a larger artery is cut ?

Because the blood pressure against the eschar is greater than the adhesive qualities of the eschar.

Why should the actual cautery be employed at a dull-red heat?

At a white heat the eschar formed is completely carbonized and would not stick; when a black heat is applied to the parts the eschar formed will adhere to the cautery.

Describe the use of cold and heat as a hemostatic.

Either one produces contraction and coagulation, but is of use only in hemorrhages from small vessels and oozing from larger surfaces.

What remedial agents—that is, styptics—are employed in the arrest of hemorrhage, and how do they act?

These chemicals when brought into immediate contact with the bleeding part, produce coagulation and contraction of the vessel. They are either applied directly to the parts or a tampon is saturated with them and held against the bleeding surface by some compressing agent. Modern surgery objects to their use, as they form a repugnant clot, favor infection, and act as an irritant. Those more frequently employed are: tannoform, tannic acid, alum, vinegar and tincture of iron.

What constitutional treatment is indicated in hemorrhage?

Unless an exhaustive hemorrhage occurred, rest is all that is required. In serious bleeding, rest, the application of heat to the body surface, and stimulants and the infusion of a normal saline solution per rectum, or in very urgent cases intravenously. In cases of internal bleeding, where the leaking vessel cannot be secured, the best agent is fld. extr. *hydrastis canadensis*.

Describe hemophilia.

A congenital tendency to persistent hemorrhages from the slightest wound.

In what animal has hemophilia been seen?

It has only been observed in the horse.

THE HEALING OF WOUNDS.

Name the various modes of repair by which destroyed tissues are replaced.

(1) Healing by first intention (*per primam intentionem*); (2) by second intention (*per secundam intentionem*); (3) by third intention (*per tertiam intentionem*); (4) healing under a scurf; (5) abnormal granulation and cicatrization.

Define healing per primam intentionem.

A primary union by cementing of the wound edges without pus formation.

Under what conditions is primary union most likely to occur?

When the hemorrhage is arrested, bloodclots and foreign bodies removed (dirt, hair, splinters, tissue shreds), when the wound is aseptic or rendered so, when the edges are smooth and straight and closely approximated, and when the wound is protected by an antiseptic dressing against secondary infection.

What kind of wounds may be readily healed by first intention in animals?

Surgical wounds, provided an antiseptic protective dressing can be applied.

Describe the macroscopic changes seen in healing by first intention.

First, the edges of the wound are united by blood, to be replaced by the so-called wound cement (a lymphoid plasma-matic liquid). About the second day the edges are red,

painful and somewhat swollen. In about one week permanent union takes place, with a little cicatrix at the site of incision.

Describe the microscopical changes in healing by first intention.

White blood cells emigrate from the neighboring vessels and invade the edges and wound cement. This cellular infiltration is due to the traumatic irritation of the parts, and is not the result of the presence of bacteria, as is the case in healing by second intention. In healing by first intention it is an expression of reaction by the injured tissues, while in healing by second intention it represents a purulent inflammation. The greatest number of leucocytes in the wound edges are met with on the third day; after that they either return to the blood vessels or die.

Describe the process of cicatrization.

The fibroblast produces the scar tissue. These are roundish cells which arise through proliferation of the endothelial cells of the vessels and those connective tissue cells which are present. The fibroblasts increase in size, and epithelioid, spindle and club shaped cells form; these again change into fibrillar connective tissue cells, which in turn form the scar tissue proper. Vascularization of the wound edges takes place at the same time, the new vessels being formed by a process of budding from the walls of the cut capillaries. The young tissue formed by the fibroblasts plus the newly created blood vessels is termed granulation tissue, which shrinks as soon as the fibroblasts change into connective tissue cells, the capillaries close, at which moment scar tissue proper is formed. The last step in healing by first intention consists in the skinning over of the scar tissue, the cells springing from the epithelial cells upon the edges.

Define healing by secundam intentionem.

The filling of a wound-gap by granulations with pus formation.

What wounds usually heal by second intention ?

All those where the fundamental principles upon which the healing by first intention is based have been disregarded. Therefore, infected wounds, those with wanting close approximation of the edges, contused wounds, etc.

Describe the macroscopical changes seen in healing per secundam.

During the first forty-eight hours the various tissues can be recognized ; at this time the surrounding neighborhood begins to swell, is reddened, exhibits increased heat and pain. About the second day the wound surface looks gray, due to a thin layer of coagulated plasma coming from the cut lymph vessels. During the next few days swelling and pain increase some more, the wound surface having a jelly-like, grayish-red look. About the fourth day the discharge from the wound is yellowish and opaque ; at this time the coagulated plasma resting upon the wound surface breaks up and, together with necrotic tissue shreds, is carried away in the wound discharge ; now little red points are seen everywhere provided the wound is first cleansed by irrigation. The fifth to sixth day these red points, which are granulations, have grown higher and are covered with thick grayish-yellow pus. Up to the eighth day these granulations become larger, so as to fill the gap between the wound edges pretty well. About the eighth day the wound surface decreases and the edges approximate. Whenever the granulations are even with the level of the skin the granulating surface becomes smooth and glistening and no further granulations are formed. Next, the periphery of

the wound shows a dry pinkish seam moving toward the centre of the granulating surface, being followed by a bluish dry seam upon the pigmented skin; this process continues until the whole granulating surface is skinned over.

Describe the microscopical changes in healing by second intention.

On the whole there is but little difference in those observed in healing *per primam* and those *per secundam intentionem*. The main point of difference lies in the fact that on account of the presence of pus-producing cocci decided irritation of the tissues is produced, as a result of which large numbers of leucocytes emigrate. Otherwise the infiltration of the wound edges, the formation of fibroblasts, vascularization—that is, the budding of the capillary vessels—the changing of the fibroblasts into fibrillar connective tissue, is in no wise different from healing by primary union.

Define healing by third intention.

It consists in the union of two suppurating granulating surfaces.

What steps are necessary to secure healing per tertiam?

Absolute disinfection of the granulating surface with perfect coaptation of the wound edges held in place by an exact suture.

To what extent is healing per tertiam applicable?

It is a most valuable method and should always be attempted, to bring about rapid and permanent union.

How long after the primary injury occurred, may healing per tertiam be possible?

To avoid ugly scars—for instance, about the head of valuable horses—a wound of a week's standing can be healed by third intention.

Define healing under a scurf.

This is a form of healing by first intention, by exsiccating the blood upon the wound by means of chemical agents, as the result of which a firm adhering scab representing an aseptic dressing is produced.

How does healing under a scab take place?

The new epidermis is supplied by the epithelial cells along the edges of the wound, these young epithelial cells being protected by the artificial scurf.

Why is healing under a scurf of importance?

At times neither suturing nor bandaging the wound is possible, the scab then taking the place of an aseptic dressing.

What agents are mainly employed to produce a dry scab?

By dusting the wound with tannoform, tannic acid, iodoform, aristol, euophen, xeroform.

ABNORMAL GRANULATIONS AND CICATRIZATION.

Under what circumstances is the normal process of granulation and cicatrization likely to become abnormal?

In wounds with decided loss of tissue, presence of foreign bodies, continuous irritation and infection of the parts undergoing healing, certain systemic disturbances.

Define caro luxurians.

It represents excessive and rapidly growing granulations, commonly termed proud flesh.

What part of the body is mainly exposed to exuberant granulations?

All those where the healing process is interfered with by more or less continuous irritations, as wounds in the flexion surface of the hock, pastern; here the continuous flexion and extension irritates the wound. Also in fistula of the withers and saddle pressures when necrotic tissue is located at the bottom of the wound, thus irritating the parts constantly; also in muscular hernia, nicely seen in deep peroneal neurectomy when the muscles protrude from an incision made into its surrounding aponeurosis; here the pinching of the parts by the slit in the fascia keeps up the irritation.

Name some other forms of abnormal granulations.

Torpid, irregular, weak, pale.

What are erethistic granulations?

Those which bleed very easily, are dark-red and very irritable and painful.

Explain coagulation necrosis of granulation tissue.

Following obstruction of the capillary vessels by inflammation or their imperfect development, the wound is covered with a diphtheritic-like membrane representing death of the upper layers of the granulation.

When is a cicatrization likely to become abnormal?

In wounds with great loss of substance cicatrization becomes incomplete and the result is an ulcer, or the scar shows an undue accumulation of cornified epidermic cells.

What is a keloid?

A hard fibrous growth arising in a scar.

Which is their favorite locality ?

In the horse, they are usually seen in the flexion surface of the pasterns, following barb wire cuts or a brush burn (rope or halter burn), and around the coronary region following calking.

How may excessive scar contraction affect a part ?

The great contractile power of the cicatricial tissue in extensive scars by puckering up the tissues surrounding the original wound may produce decided deformities, as in larger injuries of the eye-lid it may become everted (ectropium).

REGENERATION OF THE VARIOUS TISSUES.

How does the regeneration of the skin and mucous membrane take place ?

As described under "The Healing of Wounds." The epidermis and epithelium of mucous membranes are rapidly replaced.

How do muscular wounds heal ?

The power of regeneration of muscles is very limited, only taking place in slight injuries, the rule being a connective tissue scar in a muscle wound.

How do tendon wounds heal ?

Cells are thrown out from the tendon sheath and surrounding tissue; the granulations thus formed invade the blood-clot which at first was created between the two ends of the tendon. This clot is absorbed, the granulation tissue unites the ends of the tendon and is gradually changed into connective tissue until it is finally difficult to tell the difference between the new and the old tendon fibres.

How do bone wounds heal ?

Same as fractures, through an ossifying granulation tissue, involving the periosteum, bone, and marrow (see the "Healing of Fractures").

How do cartilage wounds heal ?

By proliferation of the perichondrium. In the wound is first seen a fibrous deposit, which later changes into an ossifying callus. When proliferation of the perichondrium starts, new cartilaginous tissue is also formed by cartilage cells adjoining the wound, while those cartilage cells close to the cartilage wound undergo fatty degeneration.

How do peripheral nerves heal ?

The powers of regeneration of peripheral nerve tissues are good. Provided the ends have been united artificially, new nerve fibres formed by the old nerve fibres of the central stump grow into the peripheral stump. A club-shaped swelling (fibroneuroma) forms at the end of the central stump, chiefly due to a growth of the neurilemma, when the ends of the cut nerve are separated by a distance of half to one inch (often seen in neurectomy).

How do wounds of the brain and spinal cord heal ?

Here no regeneration of the nerve substance occurs, but a connective tissue scar forms.

How do wounds of non-vascular tissues, as the cornea and articular cartilage, heal ?

It resembles the healing of vascular tissues. Leucocytes emigrate from sclera and conjunctiva, followed by cell proliferation of the fixed cells, with formation of fibroblasts, and then change into connective tissue, but vascularization springs from the adjoining sclera. In articular cartilage, the

scar, which at first is made up of connective tissue, may be changed in time into hyaline cartilage.

TRAUMATIC INFECTIOUS DISEASES.

What are traumatic infectious diseases ?

They comprise a number of accidental wound diseases, due to the entrance of bacteria or their products (toxines) into the wound.

Name the most important traumatic infectious diseases ?

(1) Traumatic fever, (2) septicæmia, (3) pyæmia, (4) suppurative of the wound, (5) cellulitis.

In a wider sense of the word, what other diseases belong to the traumatic infectious disease ?

Tuberculosis, anthrax, glanders, malignant œdema, actinomycosis, botryomycosis, etc.

SUPPURATION OF THE WOUND.

Name the cause of wound suppuration ?

Suppuration is the result of an inflammation caused by the infection of the wound by pus cocci.

Name the most important pus producing bacteria ?

The most common pus coccus is the staphylococcus pyogenes aureus, most frequently met with in circumscribed localized processes. Experiments show that subcutaneous injections of this germ usually cause an abscess; intravenous injection produces pyæmia and ulcerating endocarditis; intraperitoneal injections cause a fatal suppuration ; 2, the less.

common staphylococcus pyogenes albus; 3, staphylococcus pyogenes citrius; 4, streptococcus pyogenes; this and the first one are the most important ones; it is especially concerned in the production of progressive phlegmonous suppurations.

What is pus ?

The material which forms as the result of suppurative inflammation.

Describe healthy and laudable pus ?

It is represented by a yellowish-white odorless alkaline thick creamy liquid which does not coagulate.

What is ichorous pus ?

Pus which has undergone decomposition produced by the presence of micro-organisms of putrefaction.

What is sanious pus ?

It is pus undergoing decomposition plus blood.

By what is the quantity and quality of pus influenced ?

It depends on the consistency and vascularity of the tissues, the size and age of the wound, the kind and number of pus cocci, the time of the year, temperature, climate and species of animal.

Describe the constituents of pus.

When pus is allowed to stand in a vessel, two layers can be seen.

The upper one is thin and slightly yellowish, and is termed pus serum (Liquor puris). It contains an albuminous substance called peptone and salts in about the same proportion as the blood.

The second layer or sediment is composed of pyogenic cocci, possibly other bacteria, tissue shreds and pus corpuscles, red blood cells, droplets of fat.

Why does pus not coagulate ?

On account of the absence of fibrinogen, which has been changed into an albuminous substance (peptone) by the pus cocci.

What takes place when the suppurative process does not confine itself to the wound but spreads to the surrounding tissues ?

A diffused form of suppuration of the connective tissue is termed a phlegmonous inflammation. When the lymph vessels undergo inflammation, it is called lymphangitis ; the veins, phlebitis. When pus cocci and their toxines (poisonous alkaloidal substances developed by bacteria) enter the general circulation, surgical fever, pyæmia and septicæmia may set in.

CELLULITIS.

Define cellulitis ?

It is an infectious, mostly suppurative inflammation of the cellular tissue, and may be subcutaneous, submucous, subfacial, intermuscular, periosteal, perichondreal, tendo-vaginal, etc.

What other name is employed to designate cellulitis ?

Phlegmonous inflammation.

Name the causes of infectious or suppurative cellulitis.

Most frequently the staphylococcus pyogenes aureus and streptococcus pyogenes enter the wound.

What kind of wounds predispose to cellulitis ?

Deep, punctured, contused, lacerated ; very often the wound is small or even closed when cellulitis sets in.

What is metastatic cellulitis?

The pus cocci after entering the wound do not remain in the wound, but are carried to other parts by the lymph current.

What varieties of cellulitis are recognized?

It may be superficial or deep, circumscribed and diffused; from an anatomical standpoint, it may be interglandular, intermuscular, subcutaneous, etc.

Which is the most malignant form of cellulitis?

Septic cellulitis. It represents a mixed infection by pus cocci and septic bacteria.

What is gaseous cellulitis?

It is a mixed infection, gas being produced by gas forming bacteria (*Bacillus phlegmonæ emphysematosæ*, *bacterium coli*).

What is a specific cellulitis?

One produced not by pus cocci but by an individual definite bacillus, as in malignant œdema.

In what animals is cellulitis usually met with?

Most frequently in the horse, next in the dog, and then in the ox.

What forms of infectious cellulitis are the most common ones?

The most frequent form is the subcutaneous one, while in the horse, at least, subfacial, intermuscular, perichondreal and tendovaginal cellulitis is often seen.

Which forms of infectious cellulitis are of practical interest?

1. Subcutaneous cellulitis about the head and hind legs of horses (lips, eyelids, intermaxillary space).

2. Submucous cellulitis of the mouth and pharynx, as stomatitis, phlegmonous glossitis and pharyngitis.

3. Subfacial cellulitis, as in fistulous withers, poll evil and punctured wounds about the legs.

4. Intermuscular cellulitis, involving muscles of the neck, shoulder, legs, abdomen and croup.

5. Subcoronary cellulitis (coronary calking).

6. Perichondreal cellulitis about the lateral cartilage, as in quittor.

7. Cellulitis of the plantar cushion from nailpricks.

8. Cellulitis of the tendon sheath of the flexor tendons (horse). Subcutaneous and intermuscular cellulitis of the tail—in horses, following myotomy; in cattle, from inoculations (anthrax, blackleg).

9. Cellulitis of the prepuce and scrotum in the horse after castration.

10. Cellulitis of the mammary gland in cattle.

Describe circumscribed cellulitis?

Inspection reveals a swelling over a limited skin area. This swelling may stop abruptly, same as seen in purpura hemorrhagica. Unless deeply pigmented, the skin over the swelling is red, appears stretched and glistens. Palpation shows heat, pain, the parts being hard, soft or doughy. The skin over the swelling cannot be wrinkled.

How does circumscribed infectious cellulitis terminate?

It may terminate in (1) an abscess; here the skin looks greasy, bluish, red or blackish; palpation shows fluctuation. There may be fever. The contents of the abscess may reach the external world spontaneously. A part of the skin over the abscess undergoes necrosis, allowing exit of the pus. Unless opened artificially, the pus may burrow, leading to (2) a diffused purulent cellulitis.

Name some of the sequels to suppurative circumscribed cellulitis.

Phlebitis, lymphangitis, lymphadenitis, septicæmia and pyæmia.

Describe diffused cellulitis.

Besides extensive swelling of the skin and fever there is decided pain expressed by lameness when the locomotory apparatus is involved. Subfacial cellulitis expresses itself by more or less fever and great pain. Being deeply situated, the skin over the diseased parts either does not show anything abnormal or some slight œdematous doughy swelling. The above also applies to intermuscular cellulitis.

What course does diffused suppurative cellulitis take?

There is a decided tendency to necrosis of skin, fasciæ, muscles, etc., or death from septicæmia or pyæmia.

Describe septic cellulitis.

It is very acute in its action and spreads like wildfire, with high septic fever. On stroking the diseased parts a peculiar crepitation is sometimes felt, due to formation of gases from decomposition (septic emphysema). Its course is rapid and usually fatal.

How do the various forms of infectious cellulitis terminate?

This depends on their extent and character and the animal species. It may terminate in :

1. Resolution, quite common in circumscribed cellulitis and in that form commonly known as lymphangitis (Monday morning disease, seen in the hind legs of horses).

2. Abscess, met with in all forms of cellulitis; when superficially located there is but little danger, while the subfacial and intermuscular abscesses are often unfavorable.

3. Necrosis, likely to be seen in all forms of cellulitis. Mortification of the diseased tissues is mainly observed in septic, subfacial, intermuscular, perichondreal cellulitis, as poll evil, fistula of the withers, quittor. Septicæmia and pyæmia are often sequels.

4. Encapsulation of the abscess. The abscess becomes enclosed by a capsule, so to speak, and remains dormant; most frequently seen in intermuscular cellulitis. A common example is the shoulder abscess in the mastoido humeralis of the horse. By and by the capsule gives way and another cellulitis attack takes place. This possibly explains the intermittent attacks of diffused subcutaneous cellulitis (lymphangitis, Monday morning disease, milk leg) so often seen in the hind legs of horses.

5. Chronic endurance. Sclerosis is often seen after repeated attacks of diffused septic cellulitis in hind legs of horses, representing a chronic connective tissue proliferation and leading to enormous thickening of the skin (elephantiasis). Such a chronic connective tissue proliferation involves also subfacial, intermuscular, perichondreal tissues.

Give the treatment of infectious cellulitis.

As long as the presence of an abscess is not established, hot antiseptic sponging, irrigations and fomentations must be employed. As soon as possible the abscess should be opened, sloughs removed and the cavity irrigated with antiseptics and thorough drainage provided. The acute cellulitis of the horse's hind legs is combatted by purgatives. The best treatment of to-day consists in the hypodermic use of arecoline or intravenous use of collargolum with an external camphor treatment of the leg.

TRAUMATIC FEVER.

Describe its nature and causes.

It represents a constitutional disturbance accompanied by various symptoms, as increased body temperature, increased pulse rate, changes in the composition of the blood, changes in the distribution of the blood, disturbances of the nervatory, digestive and respiratory apparatus. Fever following non-infected wounds is termed aseptic fever, explained by the absorption of broken down bits of tissue, blood clots, effused serum, which are known to have a pyrogenous action (fever-producing). Fever following infected wounds is termed septic or bacterial fever, also intoxication-infection fever, explained by the absorption of chemical poisons (toxines) of the wound secretion, the result of the action of pyogenic micro-organisms.

How is the generation of traumatic fevers explained?

The exact origin of fevers is still somewhat dark. Nevertheless it appears that the heat centre in the brain produces and regulates calorification. Experiments have shown that irritation of the heat centre causes a rise of temperature, while paralysis of the centre is followed by a sinking of the body temperature. Irritation of the heat centre may be produced by the action of chemicals, as mallein, tuberculin, argenti colloidalis, albumoses, toxines, etc., while a depressing influence is exerted upon the heat centre by such chemicals as antifebrin, antipyrin, etc. Traumatic fevers, therefore, in the light of modern science, probably depend on the irritation of the heat centre by the absorption of poisonous chemical products contained in the wound secretion.

Describe the symptoms of traumatic fever.

(1) Rise of temperature. This may be slight when not exceeding 103 F.; moderate up to 104.9 F.; high up to 106.7 F. Its course is usually atypical, continuous or remittent, and rarely intermittent.

(2) Constitutional disturbance, only marked in high fevers expressed by psychical depression, disturbed heart action, wanting appetite, irregular state of the bowels.

Give the treatment of traumatic fevers.

The essential feature is thorough disinfection of the wounds, absolute drainage, counteropenings to allow continuous evacuation of pus. Abscesses must be incised early and the infected granulations of the abscess wall removed by curetting or otherwise, followed by application of antiseptics. As a rule no internal treatment is necessary. Should internal antiseptics be indicated, camphor, quinine, alcohol, and in cattle also turpentine are the best known means.

SEPTICÆMIA.

Define septicæmia.

It is a traumatic infectious disease, due to the introduction into the blood tissues of certain bacteria and their products of metabolism without the presence of localized internal affections, but such generalized changes as swelling of the spleen, cloudy swelling of the kidneys, liver, heart, etc.

What two main forms of septicæmia are recognized?

(1) Bacterial septicæmia, due to the presence of bacteria and transferable to other animals by blood inoculation.

(2) Septic intoxication, due to the presence of chemical poisons (toxines), not transferable to other animals by blood inoculation.

Name the most important microorganisms concerned in the production of bacterial septicæmia.

Streptococcus septicus and pyogenes, staphylococcus aureus, micrococcus tetragenous, the bacilli of mouse and rabbit septicæmia, bacillus enteritidis, bacterium coli.

How would you classify anthrax, blackleg, malignant œdema and septicæmia hemorrhagica?

Each of these diseases represents a "specific septicæmia."

Describe septic intoxication.

A type of septicæmia due to the absorption of poisonous products of metabolism of bacteria. These products of metabolism are chemical poisons of an alkaloidal nature and are known as ptomaines, toxines, etc., entering the general circulation from some necrotic focus about the body (skin, intestines, lungs, etc.).

What bacteria are of interest to the surgeon in septic intoxication?

Those enumerated under "Bacterial Septicæmia."

What is sapræmia?

A type of septic intoxication depending on the absorption of products of metabolism of saprophytes, as proteus mirabilis vulgaris and zenkeri.

Define kryptogenetic septicæmia.

A septicæmia the cause of which is not detectable.

Describe the essential post-mortem changes of septicæmia.

Blood thin and tarry; all organs show great tendency to decompose. Subserous and submucous hemorrhages, especially involving endocardium and mesentery. The voluntary muscles and heart muscle appear as if boiled, having a clay

color; spleen, kidneys and liver usually swollen. Sometimes there is parenchymatous and hemorrhagic nephritis, also catarrhal, hemorrhagic and diphtheritic enteritis; also ulcerating endocarditis. The wound may or may not be in an extremely septic state (diffused cellulitis spreading along the lymphatics).

The microscopical examination of the blood reveals numerous microorganisms of some form or other with a decided breaking down of the blood corpuscles, the white ones especially representing enormous aggregation of bacteria.

Give the symptoms of septicæmia?

The wound may or may not show septic cellulitis. The constitutional symptoms are moderate or high fever up to 107° F. and more; this high temperature is occasionally ushered in with a chill; the pulse is very rapid and small, later imperceptible. The animal is drowsy and very weak; trembling of the shoulder and gluteal muscles, even paralysis of the hindparts; mucous membranes icteric, or dark red fæces, at first juicy, later mushy and finally diarrhoeal, with colicky pains; urine dark; its chemical analysis shows albumen.

Infected wounds of what parts are often followed by septicæmia in the horse?

Purulent inflammation of tendon sheaths and articulation, as also deep and extensive subfacial and intermuscular cellulitis, terminating in death in a few hours to several days; occasionally the disease drags along two to three weeks.

How do you treat septicæmia?

Absolute disinfection of the whole wound surface; remove sloughs; provide drainage; deep recesses which cannot be

drained should be irrigated with antiseptic solution. Make long and deep incisions where fluctuation is present; in subfacial and intermuscular cellulitis, inject quantities of slightly warmed glycerine 10, iodoform 1 part. The internal treatment is of little value (excepting intravenous injections of soluble silver); nevertheless, stimulate with fearless doses of strychnine, digitalis; give tonic doses of quinine, also camphor.

PYÆMIA.

Define pyæmia.

A traumatic infectious disease, due to the absorption of pyogenic microorganisms into the circulation with multiple or metastatic abscesses in different portions of the body.

What bacteria are of interest in pyæmia?

Practically all those which are productive of septicæmia, especially the streptococcus pyogenes and the staphylococcus pyogenes aureus.

How do these bacteria enter the general circulation?

There is first the infected wound; the microorganisms multiply, may come in contact with a vein, the vein becomes inflamed as the result (phlebitis), and a thrombus is formed at this point; this thrombus undergoes puriform softening, and a piece of it is swept away into the general circulation, this little piece of broken down thrombus now being termed embolus, and since it contains bacteria it represents an infected embolus; this embolus is carried along by the blood until it reaches a bloodvessel having a smaller diameter than its own. Here the embolus stops; the bacteria which it contains now multiply and an abscess follows. In this manner abscesses develop in the various portions of the body.

Wounds of which part of the body predispose to pyæmia?

In the horse, wounds about the coronary region; in calves and colts, the umbilical region of the newly born; otherwise bone wounds.

What do you understand by septicopyæmia?

This disease is a combination of pyæmia and septicæmia.

Describe the essential post-mortem changes of pyæmia.

The essential features are purulent inflammatory foci of internal organs, as liver, lungs, spleen, kidneys, joints, tendon sheaths, heart, muscles, etc. A purulent inflammation of the synovial membrane of the joints is of special importance in navel ill of the colt (polyarthrititis pyæmica). Purulent inflammation of the serous membranes is also seen (peritoneum, pleura, meninges), also purulent inflammation of the eye (purulent choroiditis). Occasionally circumscribed hemorrhages upon the serous membranes and those pathological changes peculiar to septicæmia, then septicopyæmia. At the point of origin the veins are filled with a decomposing thrombus (purulent thrombo-phlebitis).

Give the symptoms of pyæmia.

After the wound is undergoing the process of healing and suppuration established, a very irregular intermittent fever, sometimes ushered in with chills, is observed. Multiple subcutaneous abscesses may appear suddenly here and there or symptoms of a metastatic pneumonia or those peculiar to abscesses of the liver, kidneys, brain, or serious lameness due to pyæmic polyarthrititis or tendovaginitis.

What is the duration of pyæmia?

Longer than that of septicæmia, from several days to weeks, depending on the extent and location of the metastatic

lesions. Occasionally the course is chronic, with great emaciation of the animal. Pyæmia is a very dangerous disease, but less fatal than septicæmia.

The period of reconvalescence is very prolonged.

How do you treat pyæmia?

Stop the progress of the disease by disinfection, not only of the wound, but, if possible, of the interior of the vein, provide drainage, making long and deep incisions wherever indicated. The internal treatment is of little use, but quinine, camphor and strychnine are indicated. Of all agents, intravenous injections of Crede's soluble silver salt are likely to give the best results.

SPECIFIC TRAUMATIC INFECTIOUS DISEASES.

Malignant Œdema.

Define malignant œdema?

A traumatic infectious disease, due to the entrance of the bacillus of malignant œdema and probably others into the subcutaneous or submucous connective tissue.

What kind of wounds are favorable to the development of the œdema bacillus?

Punctured wounds permitting entrance of earth dust into the subcutaneous or submucous connective tissues. Here the œdema bacillus thrives, as the proper medium is present and above all an absence of oxygen. Injury to the tongue or œsophagus by foreign bodies, hypodermic injection improperly made, operations with dirty instruments (empiric castrations).

Give the symptoms of malignant œdema.

High fever ; a rapidly spreading œdema about the infected wound. The swelling when stroked with the hand or finger emits a fine crepitus, feels doughy and is very painful at the circumference, but cold and painless at the centre. The sloughing tissues are surrounded by a thin, putrid fluid; the discharge is sanious and foul smelling. Further, symptoms of enteritis and pulmonary dyspnoea. The rapidly spreading gangrene with the presence of an emphysemic œdema are pathognomic.

Name the salient post-mortem changes of malignant œdema.

The subcutaneous tissue is infiltrated with a lemon-colored jelly, the surrounding muscles likewise, emitting also the foul odor of putrefactive gases. The fluid flowing from the parts is yellowish red, foams slightly and is of putrefactive odor. There is severe inflammation of the gastrointestinal mucous membrane, also pulmonary œdema, but no swelling of spleen.

How does malignant œdema terminate ?

As a rule, by death in one to three days ; very rarely, by abscess formation and recovery.

How do you treat malignant œdema ?

Deep incisions, removal of all sloughs, antiseptic irrigations, drainage.

Tetanus.

A specific, traumatic, infectious disease, caused by the action upon the central nervous system of the strychnine-like toxin of the tetanus bacillus.

What wounds are favorable to tetanus infection ?

Wounds inflicted in dirty parts of the body, as tail, hoof, scrotum, vagina, umbilicus, etc.; punctured wounds, especially nail pricks, coronary caulks, amputation and myotomy of the tail, setoning, castration.

What animals are subject to tetanus ?

Mainly the horse; next, lambs and pigs; then, rarely, cattle and goats. The dog seems to be almost immune.

Which are favorite places of the tetanus bacillus ?

Rich garden earth, land manured with horse manure, street dust.

What do inoculation experiments show ?

The most common form of infection is through earth, while, of course, foreign objects, as nails, splinters, dirty instruments, etc., may convey the bacillus. It does not enter the blood current, but localizes in the wound and produces a strychnine-like toxin (Tetanotoxalbumin), which on being absorbed acts upon the central nervous system, giving rise to certain symptoms.

Give the essential post-mortem changes of tetanus.

Evident pathological changes are usually absent.

How long is the period of incubation ?

Three to twenty days.

Give the symytoms of tetanus ?

These vary somewhat with the intensity of the intoxication. There is a tonic spasm, especially of the extensors of the hind extremities, neck and masticatory muscles. Ears erect and stiff, eye partly covered by the nictitans, tail elevated and stiff; saliva flows from the mouth; lips some-

what retracted; the whole body appears extended and the points of both hocks are turned out; the walk is stiff, the animal mainly supporting weight with the toe region of the hoof. By raising the head the eye is retracted and the membrana nictitans falls forward over the eye. The mouth cannot be opened (trismus). Respiration is labored and from 20 to 50 or more per minute; the pulse in unfavorable cases runs from 50 to 70. Temperature, as a rule, is but little elevated. The animal is easily excited.

What is orthotonos?

That type of tetanus where the vertebral column forms a straight horizontal line.

What is opisthotonos?

That form of tetanus where the head is elevated and the region of the back curved downwards.

What is pleurosthotonos?

That form of tetanus where the vertebral column is curved to one side.

What type of tetanus is practically the only one seen in the horse?

Orthotonos.

What is the termination of tetanus?

In the most acute form, death in one to three days; in the acute form, death in four to ten days; in the subacute and chronic form, death after several weeks or recovery in 20 per cent. of all cases.

What does the prophylaxy of tetanus include?

Antiseptic treatment of all wounds and the injection of antitetanic serum, previous to or immediately following the injury.

How do you treat tetanus?

Keep the animal in a quiet and dark place. The application of slings is of doubtful value in the horse. Thorough disinfection of all wounds, even the slightest ones. Internally, chloral hydrate, bromide of potassium, fld. extr. gelsemium, fld. extr. calabar bean, atropia, injections of tetanus antitoxin. Internal medication in tetanus, to say the least, is unreliable.

What is the rate of mortality in tetanus?

Between 70 and 80 per cent.

What other infectious diseases may follow traumatism?

1. Wound diphtheria (*Gangraena nosocomialis*) represents a coagulation necrosis of the granulations of a wound, due to the action of a specific bacillus. In the croupous and diphtheritic form the granulations change into a yellowish, purulent necrotic mass; in the ulcerous form the granulations change into a grey, mushy necrotic mass; in the pulpous form the granulations are changed into a stinking, decomposing, tarry, granular mass.

2. Glanders. Primary skin glanders very rare; infection takes place about the head, extremities, along the belly, etc. The glanders ulcers develop out of the infected wound.

3. Rabies.

4. Symptomatique anthrax.

5. Anthrax.

6. Wild plague.

7. Tuberculosis.

8. Botryomycosis.

9. Actinomycosis.

THE TREATMENT OF WOUNDS.

What two forms of wound treatment are recognized?

The aseptic and antiseptic methods.

What does the aseptic method consist of?

It is of use only in fresh aseptic germ-free wounds made by the surgeon. Such a wound does not come in contact with any antiseptics at all. It is dried with sterilized tuffers, possibly irrigated with boiled water, and finally dressed with a sterilized dry dressing.

To what extent is the aseptic method of wound treatment applicable in veterinary surgery?

In every-day practice it is not to be thought of. Most wounds are old and infected or fresh and infected. The surroundings are such that even should the desire exist to do aseptic work, it simply cannot be executed. Aseptic treatment of wounds can be best demonstrated at the colleges, but to the average practitioner it only exists in theory.

Outline the antiseptic treatment of wounds.

This includes the production of a reasonably germ-free state of the resting-place of the patient, or at least field of operation of the wound, hands and arms of the operator, instruments and dressings, and preventing subsequent infection by antiseptic dressings.

1. *Resting-place of the animal.*—The operation can be performed anywhere. Either have a straw bed or what is the best bed imaginable, one made up of a two to three inch thick layer of southern pine shavings. Just previous to the casting of the animal the bed is sprinkled with a 1 per cent. carbolic acid or permanganate of potash solution. Under-

neath the field of operation a clean rubber sheet is placed. This rubber sheet is of great practical interest, as it protects the field of operation against the invasion of bacteria from beneath, enabling the surgeon to operate almost anywhere. The hospital and college go one step further toward asepsis by providing operating tables—practically, useless; theoretically, ideal. The latest is Dollar's operating table. This mechanical contrivance upsets the mental equilibrium of any but the most decrepit old horse. The vast majority of horses cannot be gotten near it; those which you get into it almost invariably raise all sorts of disturbances before they are secured with the foot-chain, belly-strap, etc. In city practice it may be allowed to exist, but the country practitioner's experience with it on farmers' horses, which are but half broken anyway, would make quite a collection of broken bones of the head, fore and hind legs, to say nothing of the crushed fingers coming from the surgeon's anatomy.

After an operation, to prevent secondary infection the animal is prevented from lying down by tying him short. (Castration wounds in city practice; equally valuable in country practice, unless a dust and mud free pasture is given as a run.)

2. *Field of operation.*—Shave the parts; scrub with Park & Davis's mercury soap; rinse the parts with bichloride of mercury solution 1:500, and cover with a towel soaked in a bichloride of mercury solution 1:500 till the operation can be started.

3. *Hands of the operator.*—Remove dirt mechanically with brush, soap (P. & D. mercury soap) and warm water. Pay close attention to the finger nails. After scrubbing both hands and arms with soap and water for some minutes, scrub them once more in a 1:1000 bichloride of mercury solution

and rinse them in water that has been boiled. (Now do not stick them into your pants pockets, readjust a rope or touch anything but the instruments or field of operation.)

Instruments.—Boil the instruments for ten minutes in a 1 per cent. carbonate of sodium solution, then place them in a shallow tray filled with a three per cent. carbolic acid solution.

Dressings.—Sponges are hard to sterilize and should be replaced by gauze tuffers. At the same time they are hard to replace, as they soak up the discharging fluids so readily. They are best prepared as follows: After dusting them thoroughly, soak them for some hours in a permanganate of potassium solution (8 grains to 1 pint of water). Next wash them repeatedly in boiled water. Then place one dozen sponges into one gallon of water containing dissolved one-half pound of hyposulphite of sodium and add four ounces of oxalic acid; leave them in this solution ten minutes; next pack them away permanently in a three per cent. solution of carbolic water. Gauze tuffers are simply boiled for half an hour and then placed in a three per cent. carbolized solution for future use.

Bandages are best boiled and then kept soaked in a 1:1000 formalin solution.

Ligatures.—Silk is boiled half an hour and then kept soaked in a one-half per cent. formalin solution. Sterile cat-gut is best bought, as its production is rather troublesome.

A very convenient apparatus for the sterilization of knives, dressings, etc., is a formaldehyde sterilizer.

What features should the antiseptic drug possess?

It must have sufficient power to promptly destroy streptococci and staphylococci. In this strength it must not irritate the tissues and interfere with the process of healing.

It must not be poisonous to the system when absorbed. It must be reasonable in price.

Name the antiseptics of special importance to veterinarians.

Heat, bichloride of mercury, formalin, carbolic acid, creolin, protargol, iodoform, tannoform, zinc chloride, aristol.

What wounds do you dress and bandage?

All those which by the proper use of antiseptics have become aseptic, in order to protect them against the further invasion of pyogenic or specific bacteria.

When do you use a dry and when a moist dressing?

Wounds which suppurate freely or secrete freely, otherwise those with cellulitis of the neighboring tissues, are given a moist antiseptic dressing. Parts yet to be operated and to be disinfected previous to the operation are also given a moist antiseptic dressing. (Hoof, in preparing for a quittor operation; the metacarpal region previous to a neurectomy.)

How often should a bandage be changed?

It is not to be disturbed unless dislocated or unless the animal shows pain, fever or increasing swelling of the injured parts, when the bandage becomes soiled by pus or wound discharge. The odor arising from a bandage is not always a deciding feature for changing it.

Under what circumstances is an open wound treatment indicated?

Whenever the state of the wound or the part of the body prevents the application of a dressing. Under these circumstances an attempt is made to replace the regular dressing by producing artificially a firmly adhering scab on the wound surface.

Outline the treatment of wounds in general.

1. Stop the hemorrhage by compression, ligation or torsion (heat, actual cautery and styptics).

2. Do not probe with instrument or finger unless you are sure that no septic material is carried into the wound by doing so. Remove all foreign bodies whenever possible; pick them out with an artery forceps, wash them out with a stream of bichloride of mercury solution. In cases of laceration or contusion look upon the torn tissues as beyond repair and remove them with the scissors. Clean the wound by scrubbing its neighborhood with P. & D. mercury soap, cut off all hair along its edges and if possible shave the edges. Wash out the wound with some antiseptic solution (bichloride of mercury 1:500), ridding it of all bloodclots, etc.

3. *Drainage, closure and dressing.*—All infected wounds must be drained, also large and deep ones. For that purpose use gauze strips or oakum strands. Deep, lacerated and contused wounds when infected ought not to be closed by sutures, but the “open wound treatment” is best instituted. Superficial wounds which can be aseptized and those which are aseptic should be sutured. In suturing a wound, avoid excessive tension, as the circulation of the parts is interfered with by it, leading to sloughing. Wherever possible, apply an antiseptic dressing.

THE TREATMENT OF SPECIFIC WOUNDS.

Describe the treatment of a fresh incised wound.

Arrest the hemorrhage, but do not use styptic agents if it can be avoided; remove all foreign bodies; clean the wound by antiseptic irrigations. When superficial, no drainage is necessary; otherwise drain at the most dependent

part. Suture in a way to secure perfect apposition of the wound surfaces; or, if the amount of skin permits, bring the edges together, evert them, and run the sutures over the skin-ridge thus formed. Excessive tension upon the wound edges can often be materially lessened by dissecting the skin from the subcutaneous tissue all around the wound for several inches. Whenever possible, apply a dry or moist antiseptic dressing. When no bandage is applicable, dust the wound with tannoform or tannic acid, or when sutured paint it with wound gelatin.

Describe the treatment of a fresh punctured wound.

Most wounds of this sort in animals are infected. The leading point in the treatment of perforating wounds is drainage, if necessary, by counter openings, and thorough disinfection. Get pent-up effusions out of the way. Remove foreign bodies (nails or splinters broken off in the wound). Hemorrhage, as a rule, is of little importance. Should a larger vessel be injured, try compression, and if that is insufficient, enlarge the wound and ligate the artery or vein. In punctured wounds about the hoof the horn surrounding the puncture must be pared thin and the horn immediately around the opening removed; then the nail tract is to be disinfected, followed by a warm antiseptic fomentation.

Describe the treatment of lacerated and contused wounds.

As a rule there is but limited hemorrhage. When larger vessels are injured they should be tied. To avoid secondary hemorrhage all shredded tissue must be removed. Here primary disinfection is of vital importance, as the vitality of the wound is impaired. All wound recesses must be made accessible to drainage, if necessary by counter-openings. Coaptation of the wound surfaces by suturing is, as a rule,

not indicated. Active local antiseptic treatment, to encourage separation of sloughs, to prevent septic complications, are essential. For this purpose, warm, moist antiseptic dressings frequently changed, and, above all, constant irrigation, are valuable.

Describe the treatment of old and suppurating wounds.

The rules laid down for "lacerated and contused wounds" are applicable. Suppurating wounds about the head as old as one week may be healed by third intention as follows: Dress the wound with sweet oil, scrub it clean with P. & D. mercury soap; remove all shreds; irrigate with 1:500 bi-chloride of mercury solution (use several quarts); freshen the edges; coaptate the wound surface absolutely with aseptic silk and cover with dry antiseptic dressing.

Describe the treatment of gunshot wounds.

When the hemorrhage is intense, ligate the proximal and distal ends of the vessel, if necessary enlarging the wound sufficiently to get to it. Do not probe with the finger or probe unless the entrance of the wound indicates that some septic material (piece of the harness, saddle, blanket, etc.) has been carried along; those wounds demanding exploration because of extensive lacerations or destruction of vital parts can be probed, as the creature is usually doomed. It is not necessary to probe for the missile unless it interferes with the process of healing. Should the projectile become a source of irritation subsequently after healing is well established, it may then be removed with proper surgical precautions. Ordinarily, unless the wound is extensive, disinfect it and its surroundings and apply an antiseptic dressing. Extensive wounds and those manifestly septic are best given the open wound treatment. The wound tract should not be disturbed

unless evidences of inflammatory disturbances set in. Should they appear, then exploration, drainage, counter openings and disinfection become imperative.

Describe the treatment of poisoned wounds.

The stings of wasps, bees, hornets, yellow jackets are best treated with alkaline solution, as bicarbonate of sodium solution; internally, stimulants. Snake bites of the rattler, viper, copperhead, highland and water moccasin are treated by ligating the whole part if possible, and when seen early incise the wound freely and inject with the hypodermic syringe into the wound and surrounding tissues a 1 per cent. aqueous solution of permanganate of potash; internally, give alcohol and digitalis freely.

Describe the treatment of wounds with abnormal granulations.

Excessive granulations are removed by the knife, scissors or curette, and kept in check by astringents and pressure bandage, provided its application is possible. Sulphate of copper, chloride of zinc, and a mixture of tannoform and alum (equal parts) and the actual cautery are reliable.

Describe skin grafting.

It consists in transplanting bits of the epidermal layer of the skin, with the strictest of aseptic precautions, to granulating wound surfaces which on account of their extent cannot skin over by the ordinary process of healing.

Is skin grafting practical in animals?

It is not,—mainly on account of the great mobility of the parts and the limited blood supply of the skin.

CONTUSIONS.

Define a contusion.

An injury due to pressure by a blunt body, rending asunder subcutaneous tissue elements, but without a visible skin wound.

Differentiate between a contused wound and a contusion.

In a contused wound there is a primary visible infected cutaneous wound. In a contusion there is no primary visible infected wound. The distinction between them is one of degree and not of kind.

Name causes of contusions?

In the horse, saddle and harness pressure about the back, breast and head; in the hoof by shoes and crowding nails; blows, falls, etc. In cattle, blows from horns; and in the dog, bites, blows.

According to the extent and severity of the subcutaneous lesions, what degrees of contusion are recognized?

1. Contusion of the first degree. Limited hemorrhage, the bruised tissues are uniformly infiltrated by the extravasation (hemorrhagic infiltration), or the extravasation accumulates in small circumscribed patches (ecchymosis, sugillation).

2. Contusion of the second degree. The effused blood collects in a subcutaneous cavity and forms a blood tumor (hematoma). When the blood effusion spreads over a diffused area it is termed a suffusion.

3. Contusion of the third degree. The bruised parts undergo necrosis, not as the direct result of the bruising, but due to (1) circulatory disturbances caused by the injury to the blood vessels, this process being termed primary anemic

necrosis ; (2) secondary septic necrosis following the entrance of infectious agents.

4. Contusion of the fourth degree. Complete pulpification of the contused parts.

Describe the microscopical changes in bruised tissues.

Slight contusions exhibit a tearing of the smallest blood vessels and their accompanying delicate loose connective tissue. In more serious bruises the intercellular substance is ruptured, pushing the cells apart. Destruction of the cells themselves, even in most serious contusions, is seldom observed.

How does the microscopic study of contused tissues prove that the contusion per se cannot be looked upon as the direct cause of necrosis ?

It shows that while the intercellular substance may be torn, the cells themselves remain intact, preserving their vitality, thus power of regeneration.

How do contusions terminate ?

Termination differs according to their extent, location, degree, presence or absence of infection. They terminate by (1) resorption, (2) organization, (3) necrosis.

Describe the process of resorption.

Occurs in contusions of the first degree. The extravasation is taken up by the lymph vessels. First the coagulum squeezes out the serum which enters the lymph vessels; next, the coagulated fibrin becomes liquefied and is absorbed; then the white blood cells and finally the red ones disintegrate and enter the circulation.

Describe the process of organization.

Seen in more extensive extravasations, especially hema-

toma. As a result of the proliferation of the fixed tissue cells about the peripheral neighborhood of the hematoma, a cellular infiltration with subsequent formation of fibrillar connective tissue forms, eventually replacing the extravasation (this process is closely related to organization of a thrombus). Should the newly formed connective tissue not permeate the hematoma, but this chronic aseptic inflammatory process confine itself to the periphery, a connective tissue membrane encapsulating the extravasation is the result. This cyst formation is commonly seen in dogs.

Describe the process of necrosis.

Here the suppuration is due to the entrance of pathogenic bacteria into the blood extravasation. Diffused hemorrhagic infiltrations are likely to lead to septic cellulitis; the hematoma is changed into an abscess; septicæmia and pyæmia may become sequels.

Describe the symptoms of a contusion.

There is always more or less sudden swelling except in deep subfacial or intermuscular bruises, where three to four days may pass before the soft fluctuating hematoma shows. Hemorrhagic infiltrations are somewhat hard to the touch. In the first few days there is no œdematous, doughy, hard, painful peripheral swelling; in fact, this is usually peculiar to an abscess. Later on the contused area becomes harder, fluctuation disappearing as the serum is absorbed and replaced by cellular elements. Excoriation of the skin over the area of contusion may be seen. Depending on the locality of the contusion, impaired or lost function is apparent: thus, lameness, difficult mastication, apprehension of food, paralysis, contusion of nerves, spinal cord, insensibility from contusion of the brain.

Give the constitutional symptoms following contusion.

As a rule there are none. In case a large blood vessel is torn, the symptoms of acute anæmia present themselves. A rise of temperature is observed after extensive contusions (aseptic fever, due to the absorption of pyrogenous material). When contusions become complicated with suppurative processes the symptoms peculiar to them are present (necrosis, septicæmia, pyæmia).

Give the differential diagnosis of contusion swellings.

Abscess. Hard and painful in the beginning, developing gradually, with late fluctuation ; peripheral area cedematous and doughy.

Hematoma. Soft and early fluctuation ; sudden and complete developement ; no peripheral cedema, at least not during the first few days.

Abdominal hernia. Contents of tumor are compressible ; the muscular rent can usually be located by palpation.

In case any doubts exist, the contents of the swelling may be revealed by an aseptic puncture of the same.

Describe the treatment of contusions.

As a rule rest is important. In the slighter and superficial contusions, evaporating lotions, massage, or warm, moist antiseptic compresses, provided they can be applied, are useful ; otherwise, warm antiseptic bathing.

Those contusions with considerable disorganization of tissues demand a treatment which will promote the activity of the local circulation, break up and diffuse the bloodclots and serous effusions and hasten absorption. Here warm moist antiseptic dressing or bathing, according to the region involved, are imperative. After four to five days the most dependent part should be freely opened, all recesses exposed to drainage, the cavity packed with antiseptic tampons, to

be removed at regular intervals to allow thorough irrigation of the parts.

Those contusions with necrosis of the tissues and suppurative cellulitis must be treated according to the rules already laid down, namely, removal of sloughs, absolute drainage and continuous disinfection as far as it is possible from a practical and economic standpoint.

The treatment of blood cysts consists in excision.

Which contusions are of practical interest?

1. Those involving the withers, saddle region, point of the shoulder and sternum.

2. Hematoma of the croup and hind leg.

3. Contusions by the twist (lips); commissures of the lip by badly fitting headstall or from pulling; interdental space from the bit in pullers.

4. Contusions about the external angle of the ilium and about the eyes, due to rolling and tossing about, as in painful colics.

5. Bruises over the atlo axoid regions.

6. In the dog, along the neck and back, internal ear surface, from pinching bites.

7. Bruises about the elbow (shoeboil). In the dog, over the ischiatic tuberosity.

8. Bruises over the anterior carpal region, as in horses that paw and hit the knee against the manger, or in cows that are kept on hard floors and kneel a great deal; in horses, on the internal aspect of the knee and shin from interfering.

9. Bruises about the os calcis, as in horses which kick the stall partition.

10. Bruises of the sensitive parts of the hoof (podophyllous membrane), producing a hemorrhagic pododermatitis, vulgarly termed corns.

SUBCUTANEOUS RUPTURES.

Ruptures of Muscles.

Name the causes of muscle rupture.

Follows violent muscular contractions, or by the action from without of blunt agents. Occurs mainly in young animals and racehorses.

What muscles seem to be predisposed to lacerations?

Flexor metatarsi, the straight, oblique and transverse muscles of the abdomen, the crural triceps, gastrocnemius, gluteal muscles, biceps brachii, biceps femoris, triceps extensor, mastoido humeralis, longissimus dorsi, psoas, postea spinatus, etc.

What do you understand by spontaneous rupture of a muscle?

The tearing of muscles which have undergone pathological changes, as in animals exposed to prolonged high fevers.

Describe the symptoms of muscle rupture.

The most important one is impaired or lost function, depending on the fact whether the rent is complete or partial. The torn muscle, being no longer antagonized by its antagonist, has full play, followed by symptoms peculiar to each case. In very recent cases it may be possible to feel the space between the retracted ends, which it must be remembered is soon filled by a blood clot and extravasations.

How do muscle lacerations heal?

The blood clot is absorbed. The cells from the internal and external perymysium proliferate until the two ends are united by connective tissue. The ultimate damage, as a rule, is never great.

Describe the treatment of muscle rupture ?

Rest is essential ; stimulating liniments, even blisters.

What do you understand by hernia of a muscle ?

The protrusion of a muscle through a rent of its enveloping fascia.

Rupture of Tendons.

Name the causes of tendon rupture.

The same as in rupture of a muscle. Sometimes it follows spontaneously after prolonged rest, especially in animals which suffered with contagious pleuropneumonia or morbus maculosus.

How may tendon ruptures be classified ?

Spontaneous (following prolonged rest, necrosis, inflammation); complete (involving the whole tendon); partial (where only some of the fibres of the tendon are torn).

What tendons of the horse are most frequently involved in complete rupture ?

Flexor pedis perforans and perforatus, flexor metatarsi, superior sesamoidal ligament, tendo achilles, extensor pedis.

Which in the cow and dog ?

Flexor metatarsi and tendo achilles.

Which is the most common tendon rupture of the horse ?

Flexor metatarsi, and flexor pedis perforans in the foreleg.

Describe the process of healing of tendon rupture ?

After the blood has been absorbed the connective tissue scar is formed by the interfascicular connective tissue, paratendineum and tendon sheath.

A very important point, especially from the practical standpoint of operative surgery (tenotomy), is that the round cells of the original granulation tissue change into spindle-shaped cells by the tension upon the tendon wound by the muscles and weight of the body. In other words, early and regular tension plays an important rôle in the process of healing of such injuries. Another point of practical interest lies in the fact that lacerations within a tendon sheath do not heal as quickly as those outside of it, for the reason that the more loose connective tissue is present (as is the case in injuries outside of a tendon sheath), the more rapid the process of healing, since the greatest part of the new tissue comes from the paratendineum. Aseptic injuries necessarily heal more kindly than infected ones. Because the pus opposes regeneration, the infected parts slough off, which in these tissues requires some time; in between times free proliferation occurs by the paratendineum, and more or less severe thickening of the parts results.

What are the common complications of tendon rupture?

In the aseptic form, some thickening of the parts and contraction; in the septic form, decided thickening of the parts, contraction, and in case the tendon sheath becomes infected, cellulitis, septicæmia.

Describe the treatment of tendon rupture.

Attempt approximation of the parts and maintenance of the same by compression, plaster of paris cast, rest. In septic wounds, disinfect; and should the tendon sheath be involved, drain. Prevent excessive granulation of the surrounding soft parts by astringent antiseptic compresses (tannoform) until sequestration of the necrotic masses has taken place. Any thickening may be treated subsequently

by the actual cautery and blisters. In dogs, one may try to suture the torn tendon.

Give the symptoms of tendon rupture.

Vary greatly with the tendon involved. There are always functional disturbances, as excessive volar or dorsal flexion. A gap may be felt and seen, increasing on extension (flexor tendon) or on flexion (extensor tendon).

INFLAMMATION.

Define inflammation.

Inflammation, not being a definite disease, cannot be defined. It represents the response of tissues irritated by an injury with a highly complicated reactive process.

What are the phenomena of inflammation?

1. A reflex vasomotor paresis producing a dilatation of the arteries, veins and capillaries of the inflamed tissues.

2. Followed at the same time by a great increase in the rapidity of the flow of blood (hyperæmia), succeeded by a slowing and finally stopping of the blood current.

3. Concurrently with the slowing of the blood current the white blood corpuscles begin to line up and crowd along the vessel's wall (especially the veins), the red cells continuing to flow along the centre of the blood current. This condition is followed by the emigration of the white blood corpuscles into the surrounding tissues (diapedesis) from the interior of the veins through the walls of the vessel in the direction of the irritating element (chemiotaxis), which represents the condition commonly termed "cellular infiltration of the inflamed tissue."

4. As the result of the altered condition of the walls of the blood vessels a more or less abundant transudation of liq. sanguinis escapes from the dilated blood vessels, to which is added the emigration of red blood cells from the capillaries, these two representing the main cause of the so-called "inflammatory swelling."

5. The proliferation of the fixed connective tissue cells together with the emigrated white blood corpuscles are actively concerned in the production of the so-called "cellular infiltration of the inflamed tissue."

Causes of Inflammation.

Give a practical classification of the causes of inflammation.

1. Aseptic (mechanical, thermal, chemical).
2. Septic (due to the influence of pathogenic micro-organisms).

Enumerate some of the most important causes of inflammation.

1. Mechanical irritations, as contusions, wounds, pressure, laceration, etc., produce a traumatic inflammatory process. It is aseptic in healing by first intention, subcutaneous tendon and muscle ruptures, in that form of pododermatitis commonly termed founder; finally, in all inflammations of a non-infectious nature of articulations, bones, bursæ, tendons, etc.

2. Thermic irritations, as heat and cold.

3. Chemical irritants, as the application of vesicants, the action of acids or alkalis, the subcutaneous injection of certain agents, followed by a purulent inflammation without the presence of pus producing bacteria, in such pus as creolin, ammonia, turpentine.

What is the cause of an infectious inflammation?

The entrance of pathogenic micro-organisms into the tissues.

What classes of bacteria are more commonly concerned?

Staphylococci, streptococci, bacillus of tuberculosis, malignant œdema, anthrax, glanders, etc.

How do these bacteria cause inflammations?

These micro-organisms do not irritate the tissues mechanically, but become phlogogenous by their chemical products of metabolism (toxines).

What is phlogosin?

A crystallizable chemical of a phlogogenous nature, first obtained from staphylococci cultures by Leber.

Varieties of Inflammation.

According to the exudate, what varieties of inflammation are known?

Serous, fibrinous, purulent, hemorrhagic, gangrenous, diphtheritic, productive, specific.

Describe serous inflammation.

In this type of inflammation the walls of the blood vessels are but slightly altered, the exudate is watery, lymph-like, and contains but few white and red blood cells. It is more common in the skin, upon the mucous membranes and serous membranes of articulations, tendon sheaths, etc.

Describe fibrinous inflammation?

Also known as croupous inflammation, the exudate abounds in fibrin and white blood cells. When the exudation cells and the newly formed cells of such an inflamed

tissue are caught in a fine reticulum of fibrin, this membrane-like covering of the inflamed tissue is termed a fibrinous pseudo-membrane. Fibrinous inflammation is most frequently met with upon the serous membranes of articulations, bursae, tendon sheaths and mucous membranes.

Describe purulent inflammation.

Usually the result of an infection with pus cocci. The accumulation of pus may be circumscribed or diffused.

What is an abscess?

A newly formed cavity circumscribed by granulation tissue and containing pus.

What is a purulent infiltration?

It is a diffused collection of pus in inflamed tissues.

What is empyema?

An accumulation of pus in the sinuses of the head or articulations, etc.

Describe hemorrhagic inflammation.

In this form of inflammation the walls of the vessels in the affected tissues have undergone material alteration and the exudate contains a great many red blood corpuscles.

Describe gangrenous inflammation.

One of the most malignant types. The exudate is putrid, discolored and undergoing decomposition due to the presence of putrefactive bacteria.

Explain diphtheritic inflammation.

This represents a coagulation necrosis of the mucous membrane, followed either by the formation of a diphtheritic pseudo membrane upon the mucous membrane or loss of tissue in the necrotic parts.

Define coagulation necrosis.

It means local death of cells due to wanting nutrition, with subsequent disintegration of these cells and their change into a substance resembling coagulated fibrin.

Explain productive inflammation.

A chronic process leading to and followed by tissue proliferation. Depending on the nature of the produced tissue, this type of inflammation may be fungous, enduring, granulous, verroucous, adhesive, etc.

Explain specific inflammation.

Inflammations due to the action of specific agents, as glanders, tuberculosis, actinomycosis, botryomycosis.

Symptoms of Inflammation.

Name the cardinal symptoms of inflammation.

Redness, heat, pain, swelling and impaired function.

How is inflammatory redness (rubor) explained?

Pigmentation of the skin and the hairy coat of animals as a rule interferes with the ready demonstration of redness, while it is easily observed on the white skin and mucous membranes. Rubor is due to the dilated state and excessive accumulation of red blood cells in the blood vessels.

How is the increased heat (color) of the parts explained?

There is no increase in the local production of heat within the inflamed tissues, this depending mainly upon the increased flow of blood to the parts.

How is the swelling (tumor) of the parts explained?

By the dilatation of the vessels and infiltration of the tissues by the exudate.

Describe the quality of such a swelling.

This varies with the nature of the tissues involved. It may be of doughy consistency, pitting on pressure, best seen in the loose subcutaneous tissue along the abdomen, due to the presence of serum in the tissue meshes, termed inflammatory oedema. Swellings due to the accumulation of blood corpuscles or proliferating, fixed connective tissue cells are harder and do not pit on pressure because these elements are not as readily displaced by pressure from without. This form of swelling is termed plastic or cellular infiltration.

Explain the presence of pain in an inflamed part.

Following the swelling there is an increase of pressure within the inflamed organ which in return means a bruising of the sensitive nerves of that part. At the same time it is probable that the nerves themselves undergo inflammatory changes. The greater the nerve supply, the greater the swelling, and the less the inflamed part is capable of expanding, the greater the pain: for instance, in the skin, pododerm, eye, articulations.

How does impaired function express itself?

Lameness due to an inflamed muscle, which is rigid and contracted. The special senses may be impaired by the inflammatory process, and inflamed gland stops to produce its natural secretion.

Course and Termination of Inflammation.

Classify inflammation according to the rapidity and intensity of its course?

1. (a) Peracute; duration only a few hours, as malignant oedema, anthrax. (b) Acute; here the process sets in with a

decided activity to reach its climax within a few days or weeks. (c) Subacute ; duration one to two weeks.

2. Chronic. The inflammatory process is sluggish, possibly extending over years.

Depending on the extent, what forms of inflammation are of interest ?

Superficial (external skin, mucous membranes and serous membranes); deep or parenchymatous, subdivided into interstitial and parenchymatous ; in the former, the inflammation takes place in the interstitial connective tissue ; in the latter, it involves the parenchyma of the organ, as muscle fibres, glandular cells. The inflammation may be localized or circumscribed and progressive or diffused.

Name the more important terminations of inflammation.

(1) By resolution ; (2) by production ; (3) by necrosis.

Describe the termination by resolution.

Here the inflammatory exudate is absorbed by the lymph vessels with the assistance of the white blood cells.

Describe the termination by production.

Instead of the part returning to its normal condition without appreciable alteration of its tissues, as is the case in "resolution," inflammatory new growths follow the inflammatory process, as adhesions, thickening, seen, for instance, in elephantiasis, exostoses, chronic grease (dermatitis verrucosa), etc.

Explain termination by necrosis.

Gangrene of the inflamed parts is due to severe interference with the circulation or septic infection. The dead tissue is separated from the living by suppuration, the line of demarcation indicating the place where the separation which

occurs gradually takes place. Healing, after the slough has separated, takes place by granulations.

The Treatment of Inflammation.

How do you treat inflammation ?

Locally and constitutionally.

Describe the local treatment of inflammation.

1. Remove the cause. This is the most important feature. Foreign bodies must be removed, an ill-fitting bit corrected, any undue pressure from the harness or shoe corrected, etc.

2. Give rest to the inflamed part. This in itself often suffices to produce a cure. Thus the inflamed eye must be protected against light, a distorted joint kept at rest, the foundered hoof kept quiet, etc.

3. All wounds must be disinfected to prevent septic inflammations or inhibit their spreading.

4. The inflammatory process itself must be acted upon to limit itself in extent and intensity, etc., looking toward the removal of the exudate and healing of the diseased state of the walls of the vessels in the inflamed territory.

Describe the means employed for the modification or arrest of inflammatory processes.

(1) Cold, (2) heat, (3) compression, (4) drugs, (5) surgical interference.

How does the action of cold influence the inflammatory processes ?

It contracts the dilated blood vessels, restricts the exudative processes (emigration of the white blood cells, hemorrhage), abstracts the increased heat of the inflamed part, depresses the functional activity of the sensitive nerves, thus easing pain.

Describe the application of cold for the relief of inflammatory processes.

1. By immersion. The diseased part is placed into a vessel with cold water, a fresh supply of cold water being added from time to time to get the action of continuous cold (the latter being done away with in case the parts are immersed in a flowing stream, as a brook, etc.) This method is practically confined to the treatment of inflammatory states of the hoof.

2. Cold fomentations. Consists of the application of some absorbent material, as cloths, bandages, etc., kept moist with cold water. This method is not very effective unless the dressing is moistened every five minutes. Experiments have shown that the temperature of the parts drops during the first two to three minutes, to rise to within the original temperature shortly; at best the temperature can be kept down when cold is applied every five minutes, which lowers the temperature permanently some 5 to 9 degrees F. In these cases the addition of such agents as vinegar, alum, lead acetate, disinfectants (as carbolic acid, chloronaphtholeum, formalin, etc.), is of twofold value: they influence acute inflammatory processes favorably, prevent infections and ease the mind of the owner, as the mere use of cold water may seem insufficient to him.

3. Continuous irrigation. This represents undoubtedly the most valuable means of applying cold. It consists in allowing a thin stream of cold water with or without the addition of medical agents to flow continuously over the diseased part. Experiments have shown that by this method the temperature of the irrigated part dropped about 36 deg. F. after one hour's irrigation.

When is the application of cold contraindicated in the treatment of inflammation?

It is only of use in the earlier stages of acute inflammation. It should not be employed in infectious states, as it interferes with the process of healing by inhibiting the exudative process more or less, the latter being a vital factor in the process of repair. It should not be used in the treatment of serious bruises, as the vitality of the parts is already lowered by the contusion, and thus sloughing would be encouraged by the application of cold. In other words, there are few inflammatory processes which could be treated successfully by the application of cold after the inflammatory processes once existed 36 to 48 hours.

How does the action of heat influence the inflammatory process.

Temperatures ranging from 78 to 122 deg. F. dilate the blood vessels, thus increasing the blood-flow and increasing nutrition of the parts. As a direct result of this, absorption of the exudation is encouraged. Heat softens and renders less tense the inflamed tissues; consequently, pain is more or less relieved.

Describe the application of heat in the treatment of inflammation.

1. By immersion. The part is immersed in warm water, a new supply being added from time to time to keep up the desired temperature.

2. Cataplasms. Linseed meal, bran, etc., is mixed with warm water containing some antiseptic agent, as one-half per cent. carbolic acid, etc.; or, better, cotton waste (such as is used to wipe machinery) is soaked with a warm antiseptic solution and applied to the inflamed part. These have to

be renewed every three to four hours to be of any value. The best results are obtained by the so-called Priessnitz fomentation.

Describe the Priessnitz fomentation.

A cloth of an absorbent nature is dipped into cold water and wrung out. This cloth or bandage is applied to the diseased part. Over it are wrapped several layers of woolen material. In cases which warrant the expense, a layer of oiled silk or some other impervious article is applied, before the last woolen bandages are placed. The whole thing is removed and reapplied every four to six hours.

Describe the action of the Priessnitz fomentation.

The application of the cold dressing produces a temporary contraction of the underlying blood vessels, followed by a decided dilatation of them. The moist cloth or bandage soon becomes warmed by the parts with which it is in contact, and since the overlying woolen layers prevent the evaporation of heat, the temperature of the surface skin next to the moist dressing reaches body temperature. By changing the Priessnitz every three to six hours the blood vessels are induced to contract and dilate, thus vitalizing the parts, materially encouraging the reparative processes—that is, the breaking down and absorption of the inflammatory exudates.

During what stages of inflammation is heat indicated?

In all subacute and chronic forms ; whenever the vitality of the parts is low ; where there is great tension ; where suppuration is present ; when sloughs are to be separated.

When is the application of heat contraindicated?

At the very outset of inflammation, in cases of septic cellulitis and malignant œdema, as these pathological processes are encouraged by the action of heat.

How does compression influence the inflammatory process?

Compression is beneficial by promoting absorption and resolution, done by changing the rate of circulation sufficiently to bring about rapid absorption and normal nutrition. By compression, inflammatory exudates are diffused, tissues loosened bound down by adhesions.

What methods of compression are employed in the treatment of inflammation?

1. Continuous compression, as by bandaging the part.
2. Intermittent compression, as by massaging the parts with the hand or fingers.

To what extent is massage of value in animals?

Massage is a very valuable means in the treatment of subacute and chronic aseptic inflammations. Its application is limited in animals, because it should be used from one to three times daily for five to fifteen minutes each time. The presence of the hairy covering renders it less effective in animals—in fact, interferes with the proper execution of it. The pressure to be exerted upon the painful parts renders the animal intractable. Therefore it is confined to the treatment of chronic inflammations in valuable horses and other pets.

How do you massage a part?

By stroking, rubbing, kneading and tapping the part. Place a piece of stout paper which has been dressed with lard over the part to be massaged. This larded paper prevents the hair from becoming rubbed out. First stroke or rub gently the parts just beyond the inflamed area. After having thus emptied, so to speak, these tissues, massage the diseased parts in the direction of the emptied tissues, thus forcing the

exudate into the previously emptied tissues. In kneading the parts, rub the parts circularly with the pulps of the fingers, or, in the larger animals, with the closed fist. Massage by percussion is effected by tapping the surface over the diseased parts with the finger tips, the palm of the hand, or, in the larger animals, with a light wooden mallet.

What class of drugs is employed in the treatment of chronic inflammation?

Those generally known as counter-irritants.

Name the counter-irritants of special value generally employed.

Such vesicants as cantharides and red iodide of mercury and the actual cautery.

How do counter-irritants influence chronic inflammatory processes?

This question is by no means settled. Some claim that the irritant applied to the skin reflexly influences the blood vessels of the inflamed part, causing the blood to leave, so to speak, the deeper and affected parts and to accumulate in the artificially inflamed skin. The latest theory—and a rather improbable one—is that the chronic inflammation has been changed into an acute one. It is stated that the irritant causes the most deeply situated blood vessels of the chronically inflamed area to dilate, followed by exudation of serum and emigration of the white blood cells. Out of these white blood cells certain ferments are formed which digest the albuminous constituents of the chronically inflamed part, with formation of an albumose liquefaction and subsequent absorption of the more solid inflammatory products. It seems to me that the action of vesicants and the actual cautery lies mainly in these facts: first, they cause decided pain, which induces the animal to rest the part exposed to the

counter-irritant; next, as the result of the swelling of the skin and subcutaneous tissues, a more or less continuous compression of the diseased tissues is obtained, while prolonged compression even is exerted by the scar formation following the application of the actual cautery, which, as previously shown, has a favorable influence upon chronic inflammatory processes. Other factors no doubt play an important rôle, as yet to be demonstrated.

When do you employ antiseptics to combat inflammation?

Since a great many inflammations in animals are the direct result of a wound invasion by bacteria, antiseptic agents are required to inhibit their further development.

What antiseptics are indicated to influence deeply located septic inflammation?

Those which penetrate the skin, as carbolic acid, iodoform, camphor, etc.

What operative measures may be employed in the treatment of inflammation?

Venesection is to-day but little employed; nevertheless, it is of value in an acute violent inflammation, especially indicated in that acute diffuse aseptic pododermatitis commonly termed "founder."

Scarification by punctures or incisions, while not often employed, frequently give relief in intense congestions, with the integuments thick and brawny, as in rapidly spreading inflammations, deep seated suppuration. The incision or puncture must go through the skin and cellular tissue to be effective. Such wounds, of course, are given subsequently a thorough antiseptic treatment. In gangrenous inflammations the prompt removal of tissue shreds or sloughs, either by

excision or amputation, is called for (gangrene of the tail, udder, ear, etc.)

ABSCESS.

What is an abscess?

It is a newly formed cavity circumscribed by embryonic tissue and containing pus.

Describe the formation of an abscess.

First, pus producing bacteria invade a part. The small vessels of this part are distended with blood or even leucocytes, the connective tissue fibres are swollen, and the lymph spaces are filled with exudate containing enormous numbers of leucocytes; the fixed cells of the tissue also undergo changes, become nucleated, resembling leucocytes. In the meantime the cocci have multiplied and massed together, and by their peptonizing action upon the fibrin of the exudation and intercellular substance the centre of the inflamed tissue liquefies and the abscess is ready. The abscess cavity is walled in by a zone of granulation tissue, this embryonic tissue acting as a protective layer between the infected parts and the adjacent healthy tissue territory, the abscess becoming larger by liquefaction of the granulation tissue from within to without. When the inflammation finally reaches the surface, an elevation due to fluid pressure from within forms, which from tension and liquefaction becomes thinner and thinner, breaks, and the contents of the abscess cavity evacuate spontaneously.

What classes of bacteria are mainly concerned in abscess formation in the horse?

Streptococci and staphylococci. The latest researches

tend to show that the so-called botryomyces are no specific bacteria, but an aggregation of staphylococci.

What bacteria are mainly responsible for the production of abscesses in cattle ?

According to Lucet and Nocard, streptococcus pyogenes bovis, staphylococcus pyogenes bovis, bacillus pyogenes bovis, bacillus liquefaciens bovis, bacillus crassus pyogenes bovis.

What forms of abscesses are recognized ?

Acute, cold or chronic, circumscribed, diffused, gravitative, tympanitic, metastatic or pyæmic, superficial, deep, intermuscular, subfacial, etc.

What do you understand by an acute abscess ?

One following an acute purulent inflammation.

What do you understand by a cold abscess ?

An abscess the result of a chronic purulent inflammation.

What do you understand by a circumscribed, what by a diffused abscess ?

A circumscribed one is limited by a wall of granulation tissue ; a diffused one is usually more extensive and not limited by a wall of embryonic tissue.

What is a gravitative abscess ?

Abscesses point toward the point of least resistance ; therefore, depending on the nature of the tissues, the pus, trying to get out, wanders, appearing at some distant spot from its point of formation.

What is a tympanitic abscess ?

One containing gases of putrefaction.

What is a metastatic abscess?

This is a secondary or symptomatic one. It is the embolic abscess of pyæmia.

What is a superficial, deep, intermuscular, subfacial abscess?

It is termed superficial when occurring above the deep fascia; deep when occurring below the deep fascia; intermuscular when occurring in a muscle; subfacial when occurring below a fascia.

Which animals exhibit abscesses most frequently?

Horse, dog, ox.

In what region of the body are abscesses more generally found?

Intermaxillary space, point of the shoulder, coronary region of the hoof, all parts exposed to harness pressure, as neck, back, etc.; fetlock, knee.

From an anatomical point of view, where do abscesses more generally occur?

In the subcutis, below the fascia, in muscles, in the mammary gland and lymph glands.

Describe the symptoms of a subcutaneous abscess.

There is more or less local swelling, which is hardest at its periphery. This swelling shows increased heat and more or less fluctuation on palpation, as soon as the progressive softening of the tissues takes place and the pus reaches the surface. The time consumed for the "ripening" of the abscess and the intensity of the symptoms are variable, depending on the density of the tissues lying between the abscess cavity and the surface. The skin over the abscess cavity is tense and cannot be displaced, and has a peculiar fatty, glistening aspect. At the point where the abscess is shortly to break, the hair stands erect and drops out. In

non-pigmented parts the skin appears a lead color or bluish red. There may be fever.

Describe the symptoms of a deep abscess.

This is more difficult to diagnose, at least in its early formative stage. There appears soon local œdema, with a brawny feel, and other signs of suppuration, and, in case the leg is the seat of the deep abscess, great functional disturbance. Such symptoms may call for an explorative aspiration, puncture or incision made with proper precautions.

How do you treat an abscess?

As long as the local swelling is hard, hasten the softening of the tissues by continuous hot antiseptic poultices. As soon as any fluctuation is apparent, at least in subcutaneous abscess, make a lengthy incision at the most dependent part; irrigate the cavity with an antiseptic solution (bichloride of mercury 1:1000, formalin 1:1000, etc.) by means of a fountain syringe, several times daily; otherwise, institute the so-called open wound treatment.

In deeply located abscess it would be faulty to wait for the abscess to point—that is, the detection of fluctuation by palpation—as the pus may gravitate, causing extensive necrosis and septic states. As soon as a deep abscess is surmised, make an incision through the skin, puncture the fascia carefully, and now, with the disinfected finger, by boring movements attempt to reach the abscess cavity. After thorough antiseptic irrigation of the deeply seated cavity and providing drainage, inject several ounces of iodoform and glycerine 1:10, put in a drain, and after that treat same as a superficial abscess.

Why are deep abscesses opened with the finger instead of with the thrust of a knife?

To avoid injuring important blood-vessels and nerves.

Why do you combine iodoform with glycerine for the injection of deep and gravitating abscesses ?

Glycerine, being heavy, enters every nook and corner of the diseased parts, drives out and brings to the surface floating products of septic inflammation. The glycerine subsequently is absorbed, leaving behind a fine coating of iodoform. This treatment has given me excellent results.

Which are the characteristics of a chronic or cold abscess ?

The course of the chronic abscess is slow ; there is little tendency to point ; symptoms in general are slight. There is little development of inflammatory heat ; therefore it is called also cold abscess. The wall of granulations limiting it is thick and more or less organized into a connective tissue capsule.

ULCER.

Define an ulcer from a surgical point of view.

It is a granulating surface of the skin or mucous membrane with limited tendency to heal.

What two main classes of ulcers are recognized ?

Primary or idiopathic, and secondary or symptomatic ulcers.

What two main classes of causes are concerned in the production of ulcers ?

Local and general causes.

Enumerate the local causes of ulcers.

Any agent keeping up an inflammatory process in a wound, by continuously and locally irritating the wound, interferes with granulation and cicatrization, changing such

a wound into a primary or idiopathic ulcer: as pieces of necrotic tissue or foreign bodies at the bottom of a wound, continuous licking of a wound as by dogs, the persistent shaking of an injured ear (dog), etc.

Enumerate the constitutional causes of ulcers.

Certain specific local or constitutional diseases are followed by secondary or symptomatic ulcers, as the ulcer of farcy, actinomycosis and tuberculosis, corneal ulcers following dog distemper, etc.

What circumstances encourage ulcer formation in tissues?

The more any agent directly or indirectly interferes with the circulation or nutrition of a tissue, the greater the tendency of such a tissue toward ulceration. This interference with the nutrition or circulation may be brought about, for instance, by the action of pus cocci, these producing cell necrosis; or the circulation may be interfered with by pressure from an exudate upon the part, prolonged pressure, as seen in decubitus (bedsores). Finally, corneal ulcer from diminished innervation, as in paralysis of the trifacial nerve (neuro-paralytic ulcer).

According to the quality of the granulations, what forms of ulcers are recognized?

Sluggish and painless, irritable and painful ulcers.

According to the edges of the ulcer, what forms are recognized?

The healthy or simple ulcer, with a smooth, moderately indurated edge; and the callous, indolent or chronic ulcer, with a wall-like, irregular, indurated edge.

Depending on the depth of the ulcer, what forms are known?

Superficial, deep, sinuous, tubular, fistulous.

According to the quality of the surface granulations, what forms of ulcers are recognized?

Fungous, or exuberant, phagedenic, gangrenous, diphtheritic.

In describing an ulcer, what main points are to be considered?

Its granulations, edges, depth, surrounding skin, discharge, size, shape, seat.

Describe a healthy ulcer.

Granulations small, cherry-red and regular; discharges a limited quantity of laudable pus; its edges slope and are but little indurated; its shape is regular, the surrounding skin flexible.

Describe a fungous ulcer.

Usually seen after injuries followed by undue contraction of the surrounding tissues, causing an obstruction of the venous circulation here. The granulations rise above the surrounding skin; they may be large and flabby and bleed easily.

Describe a phagedenic ulcer.

It is due to infection by various micro-organisms; its edges appear as if eaten out; the surface of the ulcer is wanting in granulations, being covered with sloughing tissue.

Outline the treatment of ulcers.

In some cases rest is sufficient; for instance, dogs suffering with ulceration of the tip of the ear are prevented from shaking the ears continuously by placing a hood over head and ears. In other instances, foreign bodies, bits of necrosed bone, cartilage, tendon, must be removed before healing can take place. Then, again, the granulations or the indurated edge may have to be removed by excision, curetting, cauter-

ization, while actinomycotic ulcers are treated with iodide of potassium internally and parenchymatous injections with tr. iodine.

Do ulcers play an important rôle in veterinary surgery?

They do not. Most of them yield readily to treatment, excepting, of course, some of the specific ones, as those following the breaking down of malignant growths (carcinoma), farcy (its treatment is illegal).

Name the more important and more frequently met with ulcers of the domesticated animals.

In the dog, ulceration of the tip of the ear, cornea (distemper), tip of the tail, stomatitis ulcerosa (tooth disease), carcinomatous ulcer.

In the horse, ulcers about the lower extremities, decubitus (bedsores), carcinomatous ulcers, ulcers in the regions exposed to harness pressure.

Give the treatment of the healthy, indolent, fungous and phagedenic ulcer.

Healthy ulcer: Allow rest to the affected part. In case disintegration is evident, hasten the separation of the dead tissues by warm antiseptic poultices. As soon as healthy granulations are obtained after removal of the slough most any kind of dressing will heal a simple ulcer, as dusting the parts with tannoform, tannic acid and iodoform (3:1), etc.

Indolent ulcer: Healing can only occur by the production of granulations, to be brought about by creating hyperæmia. Soak the indurated edges for forty-eight hours by a warm alkaline antiseptic poultice. Then incise the edges at a right angle and dress antiseptically. These incisions favor contraction and granulations will sprout in them. After two days curette the whole ulcer until the parts bleed and sound

tissue is reached. Use warm antiseptic poultices for two more days. By this time all sloughs can be removed. Now treat the ulcer same as a simple or healthy one.

Fungous ulcer : Remove the mushroom-like projections with the curette. Be sure to scrape its edges well. Follow with astringent applications, as alum, tannic acid, tannoform, sulphate of copper ; and wherever possible, hold them in place by a pressure bandage ; the dressings to be changed frequently.

Phagedenic ulcer : Continuous warm antiseptic poultices to separate the sloughs. Should this be insufficient (shown by the fact that the ulceration progresses rapidly), use the curette or knife or red hot iron to overcome the septic invasion ; after that, antiseptic stimulating applications are indicated.

FISTULA.

What is a fistula ?

A tubular wound surface which does not heal and from which either pus, some secretion or excretion is discharged.

What two main classes of fistula are recognized ?

Purulent fistula and secretory and excretory fistulae.

Name the various varieties of fistula.

The incomplete or blind fistula, the complete or communicating fistula.

What is a blind fistula ?

One which leads to some necrosed tissue or foreign body, or empties into an abnormal cavity.

What is a complete fistula ?

It represents an abnormal communication between two natural cavities or canals.

What is a purulent fistula ?

It represents the sequel of a chronic, destructive, deep, purulent inflammation, continued by necrosed tissues or specific micro-organisms, discharging its purulent exudate from a tubular tract.

Name the more important purulent fistulae.

In the horse, quittor, funiculitis chronica (scirrhus cord), tooth fistula (lower premolar). In the dog, from upper maxilla, bony fistula, as from the sternum, ribs, pelvis; inferior maxilla, coccygeal vertebrae. Fistula of the withers, neck and poll, and from suppurative phlebitis.

What is a secretory and excretory fistula ?

The first one is a pathological communication between a secretory organ and the body surface; the second is an abnormal canal between an excretory organ and the body surface.

Which secretory and excretory organs are more frequently met with fistulous tracts ?

In the cow, the udder or teat. In the horse, salivary glands, œsophagus, pharynx, stomach and intestines, urethra, between bladder and rectum or rectum and vagina.

Which congenital fistula is of practical importance ?

The urinary fistula following wanting closure of the urachus in the newly born.

Describe the symptoms common to purulent fistula ?

Depending on the variety of fistula and locality involved,

the symptoms differ. But in all cases there is a discharge, either specific in nature, as milk, saliva, urine, fæces, etc., or pus coming from the external fistulous opening termed the mouth of the fistula. This external opening, as a rule, is funnel-shaped, and either covered with rather large granulations or, as the result of the reaction of the scar tissue formed by the fistula wound, the mouth is puckered. In probing the fistulous canal, a tract of variable length straight or tortuous is detected. The walls of the fistulous canal are either covered with sluggish granulations or are smooth and tough. As a rule, pain is absent unless a recent inflammation followed by acute cellulitis has set in.

Outline the treatment of purulent fistula.

The essential feature in the treatment is the removal of foreign bodies or necrotic tissues. By doing so, the destructive purulent process is stopped, healthy granulating wound surfaces replace the sluggish granulations or indurated walls of the fistulous canal, provided thorough drainage and reasonable antisepsis are established—imperative, whatever method of treatment is employed.

What two methods may be employed in the treatment of fistula?

(1) By escharotics, (2) operative measures.

Which is the more effective one of the two methods?

In the vast majority of cases, direct surgical measures, as the knife, curette, scissors, bone forceps, etc.

What does the treatment by escharotics consist of?

It consists in the injection of caustics held in solution, injected with a view to slough out those agents which interfere with the process of healing, as corrosive sublimate, nitrate of silver, tr. iodine, villate solution, and the more lately intro-

duced agent—and one certainly of great value—protargol; also the actual cautery.

What are the essential points to be observed in operating a fistula?

Do not simply split the fistulous canal; it is insufficient; but remove all chronically inflamed parts and the ulcerating bottom of the fistula, and provide drainage if necessary by counter openings. Reasonable antisepsis is necessary to avoid infection of the operation wounds by the previous purulent foci, or an acute purulent infection—that is, acute cellulitis—is likely to follow. Never operate a fistula as long as an acute cellulitis involves its neighborhood—well exemplified in quittor operations; treat this cellulitis, and then operate.

Describe the symptoms common to secretory and excretory fistula.

There is a fistulous opening and a fistulous canal, which in the secretory fistula communicates with a gland, as, for instance, in the salivary fistula in the horse, the parotid; while in the excretory fistula the fistulous tract leads to some excretory organ, as the stomach, bladder, rectum, etc. These fistulae, therefore, may discharge milk, saliva, urine, fæces, food, etc.

Do secretory and excretory fistula yield readily to treatment?

They do not; because the irritating nature and the continuous pressure of the discharge persistently interferes with the process of healing.

Outline the treatment of secretory and excretory fistula.

The actual cautery and other escharotics are of little value. Usually the best procedure consists in changing the

mouth of the fistula into a fresh wound and obliterating the opening by stitching it up. When this fails in secretory fistula, removal or destruction of the gland becomes necessary.

GANGRENE.

Define gangrene.

By gangrene, necrosis or mortification, is understood a local death of tissue.

How is gangrene classified?

Into moist and dry gangrene, aseptic and septic gangrene.

What is dry gangrene?

A process of mummification. It represents a condition resulting from loss of water of the affected tissues.

What is moist gangrene?

That form of gangrene where the necrosed tissues undergo softening or pulpification, as evaporation of the watery constituents of the tissue cannot easily take place.

What is putrid gangrene?

Necrosis plus bacteria of decomposition.

What is ichorous or phagedenic gangrene?

It is a putrid, rapidly spreading gangrene.

What is emphysematous gangrene?

A gangrene due to a mixed infection with gas producing bacteria.

Which form of gangrene is more frequently seen in animals?

Dry gangrene, as from harness pressure and decubitus (bed-sores).

Which part of the body is quite often attacked by moist gangrene?

The flexion surface of the lower pasterns in gangrenous dermatitis (aggravated scratches).

How is the gangrenous process usually limited?

At the junction of the healthy and necrosed tissues a wall of granulations is thrown out by the healthy tissues, by means of which the slough or necrosed tissues are separated from the living parts. This line of granulations, establishing the separation of the dead from the living tissues, is termed the line of demarcation.

Causes of Gangrene.

Name the causes of gangrene.

(1) Mechanical, (2) thermic, (3) chemical, (4) infectious, (5) a combination of the above.

Describe the mechanical causes of gangrene.

Most frequent one, consisting of mechanical interference with the circulation of the part, such as contusions, continuous pressure, incarceration, thrombosis, embolism.

How soon after interruption of the circulation do skin and muscles undergo gangrene?

In ten to twelve hours.

How soon after interruption of the circulation do the intestines, brain or kidney undergo necrosis?

In one to two hours.

Which parts resist gangrene considerably?

Bones and cartilages.

Describe the chemical causes of gangrene.

To this class belong the escharotics. Caustic acids, as nitric acid, destroy the cells by coagulating the albumen and form a scurf, or kill the cells, as sulphuric acid, for instance, does by dehydration. Caustic alkalies change the tissue albumen into a smeary, soapy mass, while metallic caustics, as copper sulphate, chloride of zinc, corrosive sublimate, kills the tissue cells by precipitation of a metallic albuminate and the setting free of acids. Finally, snake poisons and certain toxines produce gangrene by chemical processes.

Describe the thermic causes of gangrene.

Here excessive heat (combustion) and cold are to be considered.

Describe the infectious causes of gangrene.

Certain streptococci and staphylococci, Bang's necrosis bacillus, the bacillus of malignant cedema, anthrax, acute glanders, etc., produce gangrene by their toxines, which produce death of the affected tissues either chemically or by interfering with the circulation. Even certain fungi are also credited with such actions, as the ustilago carbo, tilletia caries, polydesmus exitosus.

Describe the compound causation of gangrene.

In all diseases where the circulatory apparatus of an animal is seriously taxed, as heart disease, general debility, fevers, cachexia, septicæmia, etc., extensive and serious decubitus is seen to follow comparatively slight traumatism, explained by the limited vitality of the tissues due to the impaired nutrition of the body.

Describe the symptoms of dry gangrene.

Since in this form the supply of arterial blood is gradually diminished, while the outflow of the venous blood is not interfered with, the tissues, aided by evaporation, gradually lose their water and mummify—that is, become hard and dry. Thus the gangrenous skin appears black or brownish, is hard and leathery, and feels cold and is painless, but little decomposition occurring in this form.

What regions of the body are mainly exposed to dry gangrene?

The neck and back, from harness pressure; in animals which are in the recumbent position a great deal, the skin over the external angle of the ilium, and about the eyes; in the dog, the tip of the tail; in cattle, the claws.

Describe the symptoms of moist gangrene.

When the arterial blood supply or the return flow of venous blood is suddenly stopped, the following symptoms—that is, those of moist gangrene—are likely to be noticed: Depending on the part involved and the extent of the lesion, there is intense inflammation, more or less impaired function, lameness, etc. The affected tissues feel soapy and soft at first and change finally into a pulpy, smeary mass, while the natural color of the tissues is changed into either a yellowish, greyish, blackish, brownish, or greenish hue. Thus, for instance, the color of the lateral cartilage becomes distinctly green. The necrotic tissues are cold and insensitive, an ichorous, foamy discharge being present, accompanied by a decided stench, due to the presence of putrefactive bacteria, especially noticed in gangrenous emphysema.

What constitutional effects may gangrene have?

It may be followed by septic and pyæmic infection.

What parts of the body are more frequently affected by moist gangrene ?

The flexion surface of the fetlock in gangrenous dermatitis, the lateral cartilage in quittors, the coronary region, the sensitive laminae, the region of the neck, poll and back, the subcutis, fasciae, and muscles, as in fistulous states ; the interdental space in pullers, the udder of goats, cows, and sheep, etc.

Outline the treatment of gangrene.

Prevent it by removing as far as possible its causes, and promote the circulation of the parts. When a serious inflammatory process threatens to terminate in gangrene, free incision of the parts may relieve the tension, as, for instance, in strangulated hernia, incision of the constricting ring. When gangrene is unavoidable, prevent infection and decomposition by thorough disinfection, and establish drainage to get rid of the fluids of decomposition retained beneath the gangrenous cover, followed by frequently changed antiseptic dressings. If gangrene localizes itself, hasten separation by warm antiseptic poultices, and after the part has cleaned off, treat same as an ulceration. Should the necrotic process continue to spread, amputate the affected part, provided economic reasons permit such a course, as in gangrene of the udder, tail, tip of the tongue, ears, claws, penis (after paraphimosis).

What constitutional treatment is indicated in gangrene ?

In those cases of moist gangrene with tendency to spread and involving the deeper parts, absorption of ptomaines is likely to occur. These are forced into the lymphatic channels and connective tissue spaces along fasciae and tendon sheath (septic synovitis), or a thin walled vein may succumb to the

attack of the toxins, and pyæmia follows. These parts cannot be drained; they are beyond reach, and are to-day best combated by intravenous injection of Crede's soluble silver.

TUMORS.

Define a tumor.

Generally speaking, it is a new growth, neoplasm, with tendency to persist, without physiological function, of non-inflammatory origin, the anatomical arrangement of its component elements differing from the tissues from which it springs.

Does this definition cover all views on tumors?

It does not, as some of the authors also include new growths of inflammatory and infectious origin and cystic enlargements.

Classify tumors from a clinical standpoint.

(1) Benignant; (2) malignant.

Outline the characteristics of a benignant tumor.

Its tissues usually are of the same nature as those from which it springs. It is mobile, usually encapsulated and circumscribed; it is painless and grows slowly because its blood supply is small; it displaces but does not infiltrate the adjacent tissues. There is no enlargement of the regional lymph glands—that is, those between the tumor and the venous circulation. It does not affect distant metastasis, and when thoroughly removed does not recur.

Outline the characteristics of a malignant tumor.

Its tissues are radically different from its tissues of origin,

being of an embryonic type; they are usually painful and develop rapidly, are seldom encapsulated and invade the most resistant surrounding tissues; therefore they are immovable. The surrounding skin is likely to adhere, the regional lymph glands become infected and enlarged. Little bits of the tumor from here reach the general circulation, followed by secondary or metastatic deposits in internal organs. When removed, they tend to recur and may lead to constitutional disturbances.

Give a histological classification of tumors.

Microscopical study of tumors permits of two main classes :

1. Mesoblastic or connective tissue tumors.
2. Epiblastic and hypoblastic or epithelial tumors.

What are connective tissue tumors ?

Those which are composed mainly of mesoblastic cells, exhibiting fibrous tissue (fibroma), osseous tissue (osteoma), cartilaginous tissue (chondroma), mucous tissue (myxoma), muscular tissue (myoma), etc.

What are epithelial tumors ?

Those which are composed mainly of epiblastic and hypoblastic cells—that is, epithelial cells; for instance, the carcinoma.

Review the etiology of tumors.

1. They are due to the influence of bacteria or coccidia—a theory gaining in probability.

2. Cohnheim's inclusion theory, viz.: During foetal development more embryonic cells were produced than necessary for foetal requirements. These embryonic cells which are in

excess and lying dormant, are stimulated by some agent or other, leading to the growth of the tumor.

3. Hereditary influence.
4. Irritation and injury.
5. Predisposition (melano sarcoma of the gray horse).
6. Age, sex, species, food.

What observations tend to show that food and age are etiological factors in the development of tumors?

The statistics of various veterinary colleges show that in carnivora (dog) carcinoma are more frequently seen than in herbivora (horse, ox); also, that carcinoma have never or but rarely been noticed in dogs below the age of two years.

What does the clinical examination of a tumor consist of?

By inspection, learn its seat and size, whether circumscribed or diffused, the nature of its cutaneous covering and that of the adjacent skin. By palpation, study its fixedness or mobility, consistency and state of the regional lymph glands, whether painless or not. Learn the age of the patient, and, if possible, the history of the development as to its rapidity. Finally, to settle doubts as to the nature of the neoplasm, a microscopical examination of a bit of the tumor may, although rarely, be called for. A general examination of the patient for constitutional disturbances should always be made.

What reasonable deductions can be made from the data obtained by the clinical examination of a tumor?

1. The seat of a tumor or the nature of the tissues in which it originated suggests the following: Tumors in the testicles or mammary gland are likely to be carcinomata, botryomycoma in the testicular cord, fibromata, papillomata and carcinomata in the skin, in the subcutis lipomata and

fibromata, osteomata in the bones, neuromata in the nerve tissue, myomata in muscles, etc.

2. The age is of some importance, as young animals are rarely affected with cancer. Sarcomata and papillomata are more common in the young.

3. In regard to the size and development, it is to be remembered that, generally speaking, malignant tumors grow quicker and are of larger size than innocent ones. Soft fibromata and sarcomata develop very rapidly, while in the horse sarcomata and botryomycomata attain a large size. Of some importance, also, is the fact whether the tumor is solitary or whether several tumors are present (multiple). To multiple new growths the papilloma and fibroma is inclined; while the sarcoma and carcinoma, when becoming generalized, give rise to multiple metastatic tumors.

4. The surface of tumors permits of some deductions. Thus, the papilloma, fibroma, botryomycoma and carcinoma are nodular or bosselated (lobulated) in the fatty tumor, smooth in the sarcoma.

5. Consistency. Sarcomata are the softest ones. The lipoma, soft fibroma, myxoma and cysts are also soft. Some types of fibromata and carcinomata are hard, while enchondromata and osteomata are of bony hardness.

6. Relationship to the adjacent and overlying tissues. Benign tumors, as fibroma, lipoma, papilloma, are usually well defined and movable, no adhesions existing between the tissues in which it originated and the adjacent skin. Sarcomata often invade the deeper tissues, while carcinomata are prone to ulceration.

7. Regional lymph glands invariably exhibit metastatic swelling in malignant tumors.

8. Animal species. Gray horses often show melano sar-

comata; otherwise, botryomycosis is quite frequent in the horse; dogs, again, are more likely to be affected with carcinoma, while actinomycosis is common in the ox.

Connective Tissue Tumors.

FIBROUS TUMOR OR FIBROMA (PLURAL, FIBROMATA).

What is a fibroma?

It is a benignant new-growth composed principally of fibrous tissue.

What two forms of fibromata are recognized?

The hard (fibroma durum) and the soft (fibroma molle).

How do these occur?

Either solitary or multiple.

Describe the hard fibroma.

It is elastic and hard, movable, and painless on section. It appears glistening, grayish-white; firm; blood-vessels scanty and small; microscopically, it is made up of variously arranged fibrous tissue, a few yellow elastic fibres and very few connective tissue corpuscles.

Describe the soft fibroma.

It is more or less soft, depending on the amount of fibrous tissue present. It is composed of loose, succulent fibrous tissue. On section, it appears grayish-white, semi-transparent, juicy, glistening. Microscopically, it is composed of more or less loose connective tissue, numerous blood-vessels and connective tissue corpuscles.

What secondary degenerative changes are fibromata subject to?

Mucoid change, calcification and ulceration.

What type of fibroma is painful?

The fibroneuroma, seen to develop at the end of a cut nerve, especially in neurectomy wounds healing otherwise than by first intention.

What is a polypus?

A pedunculated fibroma originating in the mucous membrane.

What form of fibroma is most commonly seen in animals?

The hard one. The soft fibroma is only occasionally met with in the skin of the dog.

What is a mycofibroma?

The mycofibroma or botryomycoma is a form of fibroma apparently due to the infection of the tissues by botryomyces, although V. A. Moore's (Cornell) researches, recently made, tend to show that it is not a specific infection, but most likely due to the invasion of the tissues by any one of several microorganisms, especially the micrococcus pyogenes aureus.

What is a keloid?

A proliferation of fibrous tissue originating in a pre-existing scar, most commonly seen in the flexion surface of a joint, as the fetlock, for instance.

What is a compound fibroma?

It is a tumor composed not only of fibrous tissue, but also of tissue peculiar to another tumor variety. Thus, when made up of fibrous tissue and muscular tissue, it is termed a fibromyoma; when mixed with nerve tissue, fibroneuroma; when mixed with mucous tissue, fibromyxoma, etc.

What are fibromata due to?

Nothing definite is known. Traumatic and inflammatory

influences are believed in by some, while the main cause seems to lie in a fibromatous predisposition of the tissues or animal, the exact nature of which is unknown.

Name the seats of predilection of fibromata.

1. Skin and subcutis. In the horse, they occur mainly about the sheath, head, shoulder and withers; are usually solitary and sharply defined; occasionally multiple in size; they range usually from pea to apple size. Those in the subcutaneous tissue are mostly encapsulated. In the dog, fibrous tumors, occasionally pedunculated, are common about the extremities, eyes, ears, along the back and in the mammary gland.

2. Mucous membranes. They are either pedunculated or have a broad basis. Other neoplasms exhibit the same symptoms: sarcoma, actinomycoma, lipoma.

(a) Nasal cavity. Of special importance are the fibromata growing here, as they lead to stenosis and thus nasal dyspnoea, chronic nasal catarrh (with more or less stinking discharge in case of ulceration).

(b) Pharynx, larynx. Are quite rare in the horse; in the ox, usually actinomycotic.

(c) Vagina and uterus. More commonly met with in the cow, bitch and sow.

(d) Milk ducts of the teat. Pedunculated fibromata are quite common in the cow.

(e) In the udder. They are often seen in the bitch, are hard, nodular, circumscribed, of egg to fist size, and frequently are of a compound type, as adenofibroma, myxofibroma.

(f) Testicles. Same as in the udder in both dogs and horses.

Outline the treatment of fibromata.

Early extirpation with the knife, scissors, etc., wherever possible, gives the best results. More difficulty is met with in the removal of the pedunculated fibromata, especially those pretty well up the nasal cavity, pharynx, teat, taxing the ingenuity of the surgeon. For their removal, the ecraseur, ligature, forceps, or even the hand itself are indicated. Fibromata with a very wide base are also destroyed by the actual cautery or by applying caustics at intervals.

CONNECTIVE TISSUE NEW-GROWTHS DUE TO CHRONIC
HYPERPLASTIC INFLAMMATIONS.

What is a keloid?

It is a connective tissue proliferation originating in pre-existing scar tissue.

Name the causes of keloid.

Some authors believe in a specific infection, others in a fibromatous predisposition, while continuous irritation of the parts seems to me the main factor.

Where are keloids found?

Commonly seen in the horse in the flexion surface of a joint, or about such regions exposed to continuous motion as the heels, coronet, hock, fetlock.

Describe a keloid.

They are often seen to follow barb wire cuts. Such a keloid is hairless, usually circumscribed, smooth, round, oval, elongated, firm and elastic.

What practical importance is attached to them?

As a rule, they are of no consequence, representing simply an eyesore, but may, by reason of their position and

extent, interfere with the function of a part, giving rise to lameness and pseudo stringhalt.

How do you treat keloids.

They are best left alone, excision executed *lege artis* often being followed by a larger keloid than the one which was extirpated.

What is elephantiasis ?

A connective tissue hyperplasia of the subcutis and skin.

In what animal is it most commonly seen ?

Hind legs of the horse.

What are the causes of elephantiasis ?

Chronic stasis of the venous circulation, and more frequently a chronic indurating inflammation of the skin and subcutis, such as follows lymphangitis, purulent cellulitis and the more serious forms of dermatitis about the lower extremities.

How do you treat elephantiasis ?

No successful therapeutic agent is known.

What is a tyloma ?

It is a diffused callosity of the skin originating in the subcutis, representing a connective tissue hyperplasia.

What are the causes of tylosis ?

Continuous irritation, as from the collar, traces, harness, etc.

Name the seats of predilection.

In the horse, those parts irritated by the harness, as the neck, breast, etc.; in the ox, the knee; in the dog, the point of the elbow and ischial tuberosity.

How do you treat a tyloma ?

By excision.

FATTY TUMOR, OR LIPOMA.

What is a lipoma ?

It is a benign tumor composed of cells filled with fat imbedded in a connective tissue stroma.

What forms of lipoma occur ?

The hard and the soft one.

What is the difference between these ?

The hard lipoma is composed of an excess of fibrous tissue, while in the soft variety adipose tissue preponderates.

How do lipomata occur ?

Solitary, occasionally mutiple, with a wide basis and pedunculated, as pure lipoma or mixed with other tissues (lipomyxoma, lipofibroma).

Are lipomata common in animals ?

They are not, but occur as often in a fat as in a lean animal. They seem to be met with most frequently in the dog, next in the horse, finally ox. As a rule, they are of limited clinical importance.

Describe a lipoma.

Depending on the amount of fatty tissue present, the consistency varies. As a rule, they are soft ; when tapped with the finger a peculiar tremor or pseudo fluctuation is felt. They are of variable size, circumscribed, round or oval ; as a rule painless, grow slowly and are mobile.

What secondary degenerative changes are seen in lipomata ?

Calcification and ulceration (due to traumatism).

What is the etiology of lipomata?

The same causes as enumerated under "fibromata" are supposed to be active, although it seems that traumatic and infectious causes can hardly be concerned in their production.

Name the seats of predilection of lipomata?

1. Subcutis. In the horse, about the thorax and abdomen, crural region, anus, tail and sheath. In the dog, about the inside of the thigh, shoulder and pectoral region.

2. Mucous membrane. In the horse they occupy the upper portion of the nasal cavity, originating in the mucous membrane of the septum or turbinated bones. They have also been observed in the larynx and on the epiglottis. Colic due to co-rectal obstruction from a submucous lipoma is on record. In the dog, lipomata are occasionally met with on the membrana nictitans. So far, I have seen them only in Boston terriers.

3. Peritoneum. Fatal colics have been observed when long pedunculated lipomata of subperitoneal origin wind around the intestines in both cattle and horses.

4. Mammary gland. Occasionally seen in the fat bitch.

How do you treat lipomata?

The circumscribed variety is best removed by incision with the knife. The pedunculated form may be ligated. The application of caustics and the actual cautery are not advised, as they produce nasty, badly-healing wounds.

MUCOUS TUMOR—MYXOMA.

What is a myxoma?

A benign tumor composed of mucous tissue.

Describe mucous tissue.

This tissue type is met with in the vitreous humor of the

eye, and is also represented by the so-called Whartonian jelly of the umbilical cord. Microscopically, it is composed of stellate connective tissue cells, the branching processes of which form a network in which the gelatinous basis substance is lodged.

Do all authors look upon the myxoma as an independent type of tumor?

They do not. Some claim that the myxoma is simply an oedematous fibroma or lipoma; in other words, a myxofibroma or myxolipoma. Others state that they are simply connective tissue tumors which have undergone mucoid change.

How does the myxoma occur?

Usually solitary and pedunculated.

Describe the myxoma.

It is quite rare; as a rule, small, soft, elastic, vibratory and pedunculated; grows slowly. On section, it is yellowish-grey, and a glairy mucin containing fluid exudes.

How do you differentiate these from soft, fibrous, or fatty tumors, etc.

By testing contents with hypodermic needle.

To what secondary changes are these tumors liable?

Inflammation, ulceration, fatty degeneration.

What are the causes of myxomata?

Not known.

Name the seat of predilection of the myxoma.

About the same as fibromata, as subcutis, submucosa, etc.; therefore, in the horse it is most commonly met with in the upper portion of the nasal cavity, here called nasal polypus,

having been found here also in the ox. Occasionally they are seen in the bovine bladder and uterus.

Outline the treatment of myxomata.

Early extirpation with the knife, scissors, ecraseur ; when necessary, trephining the nasal cavity to reach it.

Cartilaginous Tumor—Chondroma.

What is a chondroma ?

Chondroma, or enchondroma, is a tumor composed principally of hyaline or fibrocartilage.

How do they occur ?

Usually as a mixed tumor ; quite often solitary, while in the dog multiple.

Describe a chondroma.

They grow slowly, are firm, elastic, painless, and of variable size ; are smooth or nodular.

To what secondary changes are they liable ?

Ossification, calcification, cystic degeneration.

Name the seats of predilection.

While a comparatively rare tumor, it is most frequently seen in the mammary gland of the bitch ; further, in the testicle and on the vocal cord of the horse, costal cartilages of the horse and ox, on the jaws of dogs and horses, and in the subcutis of cattle.

Outline the treatment of chondromata.

Extirpation by knife. On the whole, they can be safely left alone, as they are distinctly benign unless impairing function by reason of their size or position. (This also refers to the mammary enchondroma of the bitch.)

Osseous Tumor—Osteoma.

What is an osteoma?

An innocent new-growth composed either of compact or cancellous bone.

How do they occur?

Solitary or multiple, with wide basis or pedunculated, either as pure or mixed tumors.

Describe an osteoma.

It grows slowly, is hard or densely hard, painless, more or less circumscribed, connected with a bone or cartilage. According to their consistency, they are known as ivory osteoma (osteoma eburneum); when capped with cartilage, as exostosis cartilaginea; when overlaid by a bursa, exostosis bursata.

What do you understand by an exostosis?

A bony new-growth, the result of an inflammation.

Name the seats of predilection.

In the horse, about the lower third of the lower maxilla and internal face of the metacarpus, in the cavities of the head of the horse and ox, and in the mammary gland of the bitch.

What is a dental osteoma or odontoma?

It is a bony new-growth originating in the developing tooth or alveolar periosteum.

Muscular Tumor—Myoma.

What is a myoma?

An innocent tumor composed of muscle fibres.

What two varieties of myomata are recognized?

1. Composed of striated muscle elements—rhabdomyoma, which is very rare.

2. Composed of non-striated muscle cells—leiomyoma.

Name the seats of predilection.

As a rule, the internal organs, bladder, stomach, uterus, intestines, testicles, ovaries, kidneys.

Are they of practical interest?

Hardly, as they are exceedingly difficult to diagnose, and beyond reach as to treatment.

What is the treatment of myomata?

The internal use of ergot may be tried.

Nerve Tumors—Neuromata.

What is a neuroma?

A new-growth composed of nerve fibres.

What two forms of neuromata are recognized?

(1) True neuroma; (2) false neuroma.

What is a true neuroma?

It is a neoplasm made up of either myelinic or amyelinic nerve fibres, rarely if ever seen in animals.

What are myelinic and what are amyelinic nerve fibres?

The former have myeline within their sheath; the latter have not.

What is a false neuroma?

It is a mixed tumor, being either a neurofibroma or myxofibroma developing from the nerve sheath.

Describe a false neuroma.

It is a pea to thumb size, somewhat movable, hard, painful new-growth of comparatively slow development, usually met with at the proximal end of a divided nerve.

What are the causes of false neuromata?

They follow almost invariably neurectomies, and are due to stretching the nerve before cutting it, or severing the nerve below the upper wound commissure, thus allowing its proximal end to project out of the upper wound commissure. This exposes the connective tissue of the nerve sheath to irritating influences, invariably seen in wounds healing by second intention—that is, those with pus formation, as a result of which connective tissue proliferation, expressed by a bulbous thickening of the proximal nerve end, takes place.

Name the seats of predilection.

After neurectomies they are found at the proximal end of the median, plantar and tibial nerves.

Outline the treatment of neurofibromata.

Dissect it loose from the surrounding tissue and amputate.

Are they likely to recur?

The amputated tumor never recurs, but since a new neurectomy has to be performed to amputate the new-growth, a new fibroneuroma may start from the recent proximal nerve stump.

Are neurofibromata of practical interest?

Decidedly so, as they cause lameness. They are very often met with, and will continue to be met with frequently, as long as the surgeon does not operate *lege artis*—that is, he must not stretch the nerve, dig around and mutilate the tis-

sues, and operate aseptically, which is practicable by reason of the ease with which it can and should be executed in all neurectomies but deep peroneal.

Vascular Tumor—Angeioma.

What are angeiomata?

Tumors composed of blood vessels.

What forms of angeiomata are recognized?

(1) The simple angeioma (angeioma simplex); it is composed of anastomosing vessels, enlarged and tortuous capillaries; (2) the cavernous angeioma (angeioma cavernosum), which consists of thin-walled spaces or even vessels containing blood; their construction resembles the corpus cavernosum of the penis, the blood flows into the space from arteries and is received by veins; the lymphangeioma, composed of dilated lymph vessels.

Describe the angeioma.

They resemble a cyst, are of bluish or purple color, have a more or less wide base, are compressible and may pulsate.

Which forms are seen in animals?

In the erectile tissues of the nasal mucous membrane of the horse the simple, and especially the cavernous, angeioma, giving rise to dyspnoea, is met with. They have also been observed in the conjunctiva, lips and gums. In the mammary gland of a cat a lymphangeioma has been reported. On the whole, they are not often observed.

To what secondary changes are angeiomata liable?

Ulceration leading to more or less hemorrhage, purulent nasal discharge, creating suspicion of glanders.

How do you treat an angeioma?

Their hidden position renders diagnosis and treatment difficult. When they can be reached, they may be punctured, fired, or liquid iron preparations injected into them, taking the precaution to compress the vessels which carry the blood out of the tumor long enough to insure coagulation, as otherwise an embolus might be swept away and lead to complications.

Lymphatic Gland Tumor—Lymphoma.

What is a lymphoma?

A tumor of lymphatic gland structure.

Where do they develop?

They originate in pre-existing adenoid tissue.

What forms of lymphomata are recognized?

1. The metastatic swelling—that is, an inflammatory hyperplasia of the lymph glands as a result of chronic disease of neighboring parts, such as tuberculosis, glanders, actinomycosis, equine distemper, catarrhal states.

2. Malignant lymphoma.

Describe the malignant lymphoma.

The lymph gland or glands undergo hyperplasia of their normal elements. It is peculiar to the disease known as pseudo-leukemia, or Hodgkin's disease. It is observed in horses, cattle and dogs. The tumors are multiple, painless; the enlargements variable, occasionally of great size; groups of lymph glands or those of the whole body may be hyperplastic; they may be hard, firm or softish, have the shape of the gland, only materially enlarged. The lymph glands more frequently observable are the intermaxillary, cervical, inguinal, those below the knee, etc.

Outline the treatment of lymphomata.

Solitary lymphomata—that is, the swelling of regionary lymph glands—when due to specific infections, are not treated (glanders, tuberculosis, etc.); those due to simple chronic nasal catarrh take care of themselves as soon as the catarrhal state is relieved; those of equine distemper undergo abscess formation and are treated as such.

The treatment of multiple lymphomata of Hodgkin's disease are not treated surgically, but iodide of potassium or arsenic, with proper dietetic regime, may be tried.

Sarcoma.*What is a sarcoma?*

A malignant tumor composed of immature connective tissue—that is, embryonic tissue.

Describe the histological structure of this tumor.

The number of cells are vastly in excess of the basis substance. The cells are either round, spindle, giant cells or endothelial cells; they have from one to more nuclei; there is no distinct cell wall, and the stroma consists of an irregularly arranged intercellular cement; in other words, there are no alveoli formed, as in carcinomata. The blood vessels, which are very thin walled or sometimes only represented by spaces, ramify among the cells, not running in the stroma as in carcinomata, because of the absence of any regular stroma.

How do sarcomata grow?

Spasmodically; now fast, now slow.

To what degenerative changes are they subject?

Cystic formation, ulceration, hemorrhage, necrosis.

Do they always occur as pure sarcomata ?

They do not, but also appear as mixed tumors, as fibro sarcoma, osteo sarcoma, etc.

What varieties of sarcomata are recognized ?

1. The round-celled sarcoma. This is usually soft, vascular, fast growing, attains often large size, and gives rise to metastatic deposits in other organs. Its round cells vary in size and are imbedded in a homogeneous intercellular basis substance. On section they exhibit the vascularity and consistency of brain matter.

Name the subvarieties of round-celled sarcomata.

(a) The lympho sarcoma. Grows in lymphatic glands.

(b) The alveolar sarcoma. So called as each cell is enclosed in a separate space or alveolus by the basis substance.

(c) Melanotic sarcoma. Here the cells and the intercellular basis substance is pigmented, due, according to the latest researches, to specific embryonic cells capable of producing pigment.

2. Spindle-celled sarcoma. It is composed of oat-shaped cells or of very elongated bodies. A subvariety is the melanotic sarcoma.

3. Giant-celled sarcoma. It is made up of round and spindle cells and large bone, marrow-like cells with many nuclei. Their consistency is from that of jelly to that of muscle.

4. Mixed-celled sarcoma. Composed of an admixture of round, spindle, star-shaped cells.

5. Endothelioma or angiosarcoma springs from the endothelial cells of lymph and blood vessels, which become enlarged and cylindrical. They are very malignant and subject to hemorrhage.

6. Melanotic sarcoma. Mainly seen in gray horses, but also in sorrels, blacks and bays. It is either a round or spindle celled sarcoma, developing quite rapidly, and subject to metastasis. As previously stated, it is pigmented, this pigmentation depending upon the so-called melanocytes.

Which seats of predilection are of practical importance?

1. Bones. In horses and cattle, in the nasal cavity and sinuses, leading to nasal dyspnoea and chronic catarrh. In the dog, they are usually seen on the upper jaw, the tumor having received the name of Epulis; it is located on the gums, loosening and displacing the teeth, appearing as a firm or hard, painless, irregular-surfaced proliferation. Solitary and multiple osteosarcomata are seen also in the horse, cattle, swine and dog, in the scapula and humerus, femur and tibia, temporal bones, cervical and dorsal vertebræ, and according to the part involved may give rise to lameness or even paralysis.

2. Lymph glands. In the horse, they are met with as soft, cystic or fluctuating neoplasm in the intermaxillary space at the point of the shoulder, on either side of the sheath or in the glands of the pubic region. In the dog, the pubic and neck region at times exhibit them.

3. Skin. In the skin and subcutis of the horse they are seen in the scapula and cervical region, often forming here large tumors, which may undergo gangrenous changes, and by their pressure upon the trachea may interfere with respiration. Other places involved are the sheath, lips, anus. In dogs, they are seen about the extremities; while in bovines, about the vulva and vagina.

4. Eye. They occasionally develop in the orbital cavity of the horse, cat and dog, producing strabismus, etc. In such cases they may destroy the bones and enter the frontal

maxillary sinuses, and even cranial cavity. In the eye proper they are found upon the choroid and retina.

5. Testicles. The gland continuously enlarges until eventually it softens. The same may be said of sarcomata developing in the thyroid, mammary and parotid glands, although in these the growth may also be circumscribed.

6. Sub-pleural or peritoneal sarcomata are quite common in the dog, horse and ox, but being beyond reach are of no surgical interest.

7. Melanotic sarcoma. Most commonly met with in the gray horse, but also occur in sheep, ass, dog and ox. They are either solitary, multiple or generalized. They may develop almost anywhere, even in bones and muscles, but usually are seen about the anus, vagina and vulva, penis, sheath or tail, about the cheeks, eyes, lips. The metastatic deposits are more frequently seen in the lungs, lymph glands, heart, liver, etc.

What are the prognostic features of melanotic sarcomata?

Even when generalized they do not lead to constitutional disturbances except by reason of their position, as, for instance, one interfering with defecation would sooner or later lead to a fatal colic, etc.

Describe the treatment of sarcomata.

Early extirpation with the knife is essential. After metastatic changes have once established themselves no treatment is of any use. Isolated and hard fibro-melano sarcomata may be successfully removed, as this form of melano sarcoma is of a rather benign type.

The treatment of sarcomata with caustic, as arsenic, etc., is nonsensical. All cancers supposed to have been cured with such and similar paste, usually received by some empiric under the promise of secrecy, were of a benign tumor type.

Epithelial Neoformations—Epiblastic and Hypoblastic Tumors.

CARCINOMA.

What is a carcinoma?

A malignant tumor growing from epithelial surfaces, having its epithelial cells clustered in nests (alveoli) bounded by fibrous tissue.

Are carcinomata found in non-epithelial tissue?

They are; but in these cases they are secondary (metastatic).

What do you understand by cancerous cachexia?

This, also termed carcinomatosis, represents a nutritive disturbance, a generalized chronic sepsis, a sort of auto-intoxication, most likely due to the absorption and diffusion of secondary products originating from the carcinoma.

What forms of carcinomata are recognized?

1. The squamous-celled epithelioma.
2. The cylindrical or columnar celled epithelioma.
3. The acinous or spheroidal celled carcinoma.

Subdivided into :

- (a) Hard or scirrhus cancer.
- (b) Soft or encephaloid cancer.

Describe the squamous-celled epithelioma.

It springs from the skin or mucous membranes; in other words, from free epithelium-clad surfaces, especially at the junction of cutaneous and mucous surfaces. It is composed of flattened cells, surrounded by a fibrous stroma; such a nest of cells is called epidermic pearls or cell nests. It begins usually as a wart-like growth or fissure, ulcerating early. On section,

they are not very juicy, white, rather dense and homogenous ; the consistency is greater than the surrounding tissue ; the regional lymph glands are invariably involved, especially seen in the epitheliomata originating from the skin or mucous membranes of the head (submaxillary lymph glands).

Name the seats of predilection.

Any mucous or cutaneous surface, as the skin, mucous membranes of the vagina, bladder, mouth, pharynx, penis, etc.

Describe the cylindrical-celled epithelioma.

This springs from the cylindrical surface epithelium of mucous membranes, and shows no "cell nests." The walls of the diseased organs exhibit infiltrating indurated masses, which ulcerate early. It is composed of masses of epithelial cells, and a fibrous tissue stroma in which columnar cell lined tubular glands rest.

Name the seats of predilection.

The mucous membranes of the intestines, uterus and stomach.

Describe the acinous-celled carcinoma.

Depending on the amount of fibrous tissue present, it may be soft or hard. In the former, the so-called encephaloid cancer, the cellular element predominates; while in the latter, or scirrhus, the fibrous framework predominates. This also explains the rapidity of their growth, the soft one developing much more rapidly and ulcerating earlier than the scirrhus type.

The acinous carcinoma originates only in the glandular epithelium. The hard cancer, as its name indicates, is a hard, tuberos growth at first movable with the gland ; later, by infiltration, the surrounding tissue becomes immovable, as it

adheres to the skin and adjacent tissues. In due time it usually implicates the regional lymph glands, and the finale is ulceration of the superjacent parts. Such a carcinomatous ulcer appears, with hard, everted edges, irregular outline and depth, rarely showing granulations, and is usually covered with sloughs. On section the knife creaks as it passes through, the cut surface having a cupped appearance. It is firm and white, very succulent, yielding the so-called cancer juice, a milky fluid mainly composed of epithelial cells.

The soft variety on section appears somewhat like brain substance, both in consistency and looks, for which reason it is also called encephaloid. It is soft, and grows much more rapidly than the scirrhus form. They may form bosselated masses or globular bodies, or are composed of a number of rounded masses. They ulcerate readily, at times exhibiting a nasty, fungating, easily bleeding, mushroom-like mass termed "fungus hæma todes."

What secondary changes are carcinomata liable to?

Ulceration, cystic degeneration, fatty and myxomatous changes.

Name the seats of predilection.

Testicles, mammary glands, parotis, thyroid, prostate gland, kidneys, liver, sudorific and sebaceous glands, etc.

How is the behavior of carcinomata explained?

The blood vessels are normal and ramify in the stroma (in the sarcoma they are thin-walled and ramify among the cells). The individual cells of the carcinoma are always of the type of the parent cell; for instance, those originating from the skin are squamous, those from glands are spheroidal, etc. Those carcinomata having little fibrous tissue grow fastest, as their blood supply is rich and evenly distributed,

not enough fibrous tissue being present to obliterate the vascular supply by active contraction of this fibrous stroma. In the slowly developing tumors the blood supply is scanty from the beginning, on being confined mainly to the periphery of the growth, having been destroyed in the central portion by the rapidly forming and contracting fibrous tissue. These central portions, therefore, undergo fatty degeneration and break down, that is, ulcerate, provided they are located near a free surface, as the skin. Since the stroma in some forms of carcinomata is very limited, the blood vessels of such a tumor have but little support; thus hemorrhage into the substance of the tumor or bleeding from the ulcerated surface is explained. The metastatic disposition of the cancerous tumors is explained by the fact that the cells proliferate in the connective tissue, lymphatic spaces reaching from here the nearest lymph gland (regional lymph gland). From here another lymph gland is attacked, until eventually the viscera are reached. Whenever this occurs the general health suffers, and the state carcinosis or cancerous cachexia sets in, leading to death from impaired nutrition, by the purulent and hemorrhagic discharges, involvement of important viscera, most likely also helped by the absorption and diffusion of septic products arising from the ulcerating carcinoma.

Give the etiology of carcinomata.

No positive data exist, and a great many theories applied to human carcinosis are of no value whatsoever in our animals.

1. Age. Since a great many animals for economic reasons are not permitted to reach an advanced age, little can be said as to influence of age in carcinomata. In the ox, therefore, very few cases, indeed, are on record. In the dog, it appears that they are unknown in those younger than two

years old, the vast majority having been met with in the dog five years and older. In the horse they are also more frequently seen in the older animal.

2. Food and hereditary tendency are claimed by some to be of etiological moment, it occurring especially in carnivora and rarely in herbivora. These two points seem of very doubtful value.

3. Irritations. I do not believe that irritations either traumatic or chemic are the direct causes; they simply predispose. Experiments made upon animals by exposing them to continuous irritation have failed to produce carcinomata. Furthermore, carcinomata are found in parts which are not exposed to irritations, as the thyroid gland, mucous membranes of the head, etc. Cancer of the lip and tongue, places certainly exposed to decided irritation, for instance, in the horse, according to this theory ought to be frequent, but, on the contrary, they are very rare indeed.

4. Parasitic infection. All the various bacteria and coccidia so far named as etiological factors, on further experimentation have proved to be saprophytes, and in the case of protozoa and coccidia proved to be no coccidia at all, but degenerative changes of the epithelial cell, their nuclei or nucleoli. In defense of this parasitic theory it is stated that cancer has been produced by artificial inoculation. But since most of the inoculation experiments turned out negative, this theory also needs further support.

5. Cohnheim's inclusion theory also fails to explain the development of most carcinomata, and is only applicable in those cases so rarely met with, primary carcinoma of bone or lymph glands.

In which animals are carcinomata mainly seen?

Horse, dog and cat.

What anatomical structures most commonly exhibit carcinoma?

In the horse : Mammary gland, kidneys, testicles, facial bones, ovaries, stomach, penis, retropharyngeal glands, spermatic cord, epiglottis.

In the dog : Skin, mammary gland, anus, prostate, testicles, vagina, penis, thyroid. In this animal cancerous cachexia is not an infrequent occurrence.

How rapidly do carcinomata develop ?

The proliferation may persist for months or years ; the primary hard tumor develops slowly.

How does the frequency of sarcomata compare with that of carcinomata ?

Carcinomata are not as often seen as sarcomata.

Generally speaking, which parts exhibit carcinomata oftenest ?

Sexual organs, mammary gland and thyroid.

Describe the carcinoma of the skin.

Most frequently seen in the dog on the ears, eyelids, prepuce, scrotum ; on the tail and back, anus and lower extremities. In the horse : the tail, prepuce, penis.

The skin cancer may be circumscribed or diffused, infiltrates the surrounding tissues and leads to ulceration of the skin. It is usually hard, of irregular surface, has secondary nodules in the surrounding parts and secondary swelling of the regional lymph glands. Those about the penis are usually of large size and of ragged appearance.

Describe the carcinomata of the mucous membrane.

In the horse those in the superior maxillary sinus are firm, lobulated, vascular new-growths, containing a milky fluid, with a tendency to break into the frontal sinus or into the

buccal cavity, accompanied with early swelling of the regional submaxillary glands. The same refers to those of the pharynx of the dog. They are also seen on the membrana nictitans of the horse and may fill the whole of the orbital cavity, eventually destroying the adjoining bones entering the sinuses. In the horse, dog and ox they are further seen upon the mucous membranes of the vagina, uterus and bladder. The only case of lingual carcinoma was observed in England on a twelve year old cat.

Describe the acinous carcinoma.

The mammary gland of the dog seems most frequently involved. They vary in consistency and size, and are mostly painless; the surrounding parts exhibit cancerous nodules; the skin may or may not be ulcerated; the regional lymph glands are usually infiltrated. They may become very hard by calcification or ossification, but may also show fluctuation on account of cyst formations. Those of the testicles lead to a decided enlargement of the glands, thickening of the spermatic cord, and swelling of the inguinal glands.

Those of the thyroid gland are of interest. In the horse and dog they develop like a stroma, causing rapid emaciation and marasmus. They may attain a large size in the dog, exceeding in the horse the size of a man's head.

The prostatic carcinoma in the dog, getting the size of a man's fist, is diagnosed by rectal palpation, it leading to constipation by obstructing the canal. Those in the dog about the anus are of mushroom or warty-like appearance, and quite common.

The carcinomata involving internal organs are of little surgical interest, at least from a practical standpoint. Usually multiple and subject to metastasis, involving the pleura, peritoneum, mediastinal glands, etc.

How do you treat carcinomata ?

Early extirpation with the knife. The best results give those about the anus, membrana nictitans, skin, penis, mammary gland and testicles. The operative treatment of those of the sinuses of the head is very unsatisfactory ; this refers also to the removal of the thyroid gland.

In pet dogs with inoperable carcinomata, it would not be out of place to inform the owner of the possibility of an infection. The operating surgeon should take care of himself, as it is a fact that a number of veterinarians belonging to our times have succumbed to carcinomatosis.

Papilloma—Warty or Villous Tumors.*What is papilloma ?*

An innocent mixed tumor, representing a proliferation of the papillary body and hyperplasia of the epithelium of the skin and mucous membranes.

Do all authors agree with this definition ?

Almost all modern investigators do, although some still state that the papilloma should be counted among the fibromata, representing a connective tissue proliferation of the papillary body.

What forms of papillomata are recognized ?

1. The wart (verruca).
2. Condyloma.

Describe the papilloma.

Their structure shows one or more central blood vessels surrounded by a varying amount of connective tissue, the whole being covered by epithelial cells like those of the skin or mucous membranes. The warts may be solitary or multiple,

usually circumscribed, more rarely represented by cauliflower-like masses. They are hard, covered by horny epithelium, the vascular supply as a rule being small. Of the other type, the condyloma, but little is known in animals. It is a soft papilloma, quite vascular, moist, and not covered with horny epithelium, showing a granular, cauliflower-like surface.

Give the etiology of the papillomata ?

Continuous irritation seems to be actively concerned. Thus papilloma about the vulva seems to follow chronic discharges, the verrucous form of dermatitis following the infectious and subsequent chronic inflammation of the skin in the flexion surface of the fetlock.

Horses and cattle grazing on stubble pasture get papillomata about the lips. Another factor is heredity ; puppies, colts and calves are born with them. In some instances it almost appears as though some infectious agent was concerned in the etiology of papillomata. I have seen every calf belonging to the South Carolina Experiment station within one month become covered with warts of variable size, the animals distinctly running down while affected with papillomatosis. Inoculation experiments proved negative ; also histological and bacteriological studies failed to throw any light upon the subject.

What animals show papillomata most frequently ?

The horse, cattle and dog.

Name the seats of predilection.

In the colt, about the lips, nostrils, eyes, ears and prepuce ; in older horses I have seen them most frequently about the nose, on the belly and legs. In the dog, about the lips, eyelids, ears, cheeks, anus, prepuce, legs, and upon the

mucous membrane of the mouth. It seems that water spaniels are predisposed to them, as the vast majority of papillomata upon the mucous membranes of the mouth was met with in this animal, hundreds of papillomata densely packed upon the mucous membrane lining the cheek having been seen in patients of mine. Those upon the mucous membrane were soft, yet not vascular, while those ordinarily encountered are of variable size and basis, covered with horny epithelium, the surface resembling a straw or mulberry.

In cattle, the head, neck, along the spine, shoulders, teats and udder. They vary greatly in size ; those about the udder and teats, as a rule, thin and slender, or short, stubby and smooth ; in other places they are rough, bosselated and covered with a heavy coat of horny epithelium, with broad or small basis. Papillomata of the mucous membranes of the pharynx, œsophagus and bladder have also been observed.

Give the treatment of papillomata.

They can either be cut or twisted off. Caustics, while not as surgical and safe, are also employed. I managed to have very prompt results in the treatment of the South Carolina outbreak with large doses of potassium iodide and arsenic.

Adenomata—Glandular Tumors.

What are adenomata ?

They are innocent growths, composed of tissue closely resembling glandular tissue, originating from pre-existing glandular tissue.

What forms of adenomata are recognized ?

1. The acinous type.
2. The tubular adenoma.

Are adenomata absolutely innocent?

They are not; there seems to be a slight tendency to a conversion into carcinomata.

Describe the adenoma.

They originate from a secreting gland; are of variable size; are encapsulated; single, but may be multiple; are of slow growth and do not disseminate. Usually they are firm to the touch unless cysts have developed in them; appear usually as mixed tumors, being rare as pure adenomata. The acinous form is made up of acini, which communicate with each other by duct-like channels, the acini being lined with spheroidal epithelium. The tubular adenoma is composed of tubules lined with cylindrical epithelium.

How common are they in animals?

On the whole they are not often seen, excepting the adenoma of the thyroid gland of young dogs (stroma hyperplastica simplex); more rarely in the horse.

Give the treatment of adenomata.

In animals the hyperplastic stroma, especially in the dog, is about the only form of adenoma coming into consideration. In the horse removal of the thyroid is well borne, while in the dog removal of both lobules leads promptly to death in four to five days after the operation. The removal of one lobe (the largest one) is also well borne by the dog. In the dog, therefore, internal medication with iodide of potassium with external iodine application, or injections of diluted tincture of iodine, is employed with fair results.

Cysts.

What is a cyst?

It is a bag-like neoformation, containing either fluid or

semi-fluid, hemmed in by a fibrous lining, covered either with endo or epithelium.

What forms of cysts are recognized?

1. Degeneration cysts.
2. Exudation cysts.
3. Extravasation cysts.
4. Retention cysts.
5. Cysts of congenital origin.
6. Genuine cysts.

Describe degeneration cysts.

These are cysts arising in pre-existing tumors, due to fatty, mucoid, etc., degenerations taking place in the tumor. These cysts contain mucoid or fatty, etc., fluids, and are usually observed in sarcomata and carcinomata, and then called cysto-sarcoma, cysto-fibroma, etc.

Describe the exudation and extravasation cysts.

When a soft part is exposed to a contusion of sufficient severity, a hematoma or lymph extravasation occurs. As a result of the aseptic inflammation which follows, this fluid becomes encapsulated, and a hollow neoformation containing serum is the result, being in this instance an extravasation of blood cysts.

The exudation cyst is the result of excessive secretion into a closed cavity, as a bursa, tendon, sheath, etc., usually the result of a previous inflammation.

Give examples of both.

The extravasation cyst is seen about the neck and back of dogs after bites or on the haunch of the horse after blows. The exudation cyst is seen in the capped hock and capped elbow of the horse.

Describe the retention cyst ?

These are the result of the retention of the secretion of a gland.

What forms of retention cysts are recognized ?

1. The sebaceous or atheromatous cyst, due to the dilatation of a sebaceous gland. Seen in the skin of the horse above the false nostril and internal canthus of the eye ; in the dog, in the skin of the back.

2. Mucous cysts are due to the dilatation of a mucous gland. They may occur wherever a mucous gland exists. In the horse, ox, and dog the retention cyst of the sublingual gland below or on the side of the tongue is termed ranula ; retention cysts are further observed in the vagina of cows (Bartholinine's gland); also on the lips in the trachea nasal cavity.

Retention cysts of large glands, due to the closure of a number of ducts or of the main duct, especially seen in the mammary gland of the cow, is termed a lacteal cyst.

Describe the congenital, or dermoid, cyst.

These are due to the inclusion of a bit of the epiblastic layer in the mesoblast ; the wall of such a cyst may show all the histological features of the skin. Dermoid cysts are met with at the base of the ear of horses and cattle. A little fistulous opening with a glairy discharge is seen ; the opening leads to a cystic cavity containing a tooth.

Describe the genuine cyst.

These, also termed cystomata, are epithelial neoformations in glands with cyst formation. They have been observed in the parotid, mammary gland, thyroid gland and ovaries.

Give the treatment of cysts.

The essential feature is the removal of the lining sac. If any part remains it will simply proliferate, and the trouble returns. This holds good especially with the sebaceous and mucous cysts. The operation for dermoid cysts consists in the removal of the tooth, if necessary with hammer and chisel, and a thorough curetting of the cyst walls.

Infectious Neoformations.

ACTINOMYCOMATA.

What is an actinomycoma?

It is an infectious new-growth, caused by the ray fungus or actinomyces.

What organs are subject to actinomycotic infections?

Any part of the body may become infected. In America the seats of predilection are the upper and lower jaws, the parotid gland and the region of the throat; in England, the tongue; in Denmark, the soft parts of the head; and in Germany, the pharynx and bones of the jaw.

Describe the diagnostic features of the actinomyces fungus.

Imbedded in the soft part of the tumor or in the abscess they appear as pale-yellow to sulphur-yellow minute grains macroscopically. With a magnification of 250 diameters, the grains are seen to consist of roundish masses of club-shaped bodies radiating from the centre.

Describe the actinomycoma.

Upon the part attacked depends the amount of connective tissue it possesses. The consistency of the tumor may be firm or soft. The growth of the tumor is slow. When arising in the soft parts of the head, a rather firm swelling

is seen, from which one or more nut to egg sized tumors project. These tumors eventually break through the overlying skin and appear reddish, fungoid-like masses. Then, again, the original swelling becomes an abscess, bursts, discharging a creamy pus, the abscess cavity later filling with a fungus-like growth, eventually projecting beyond the opening through which the pus was emptied. The tumors seen in the pharynx are either pedunculated or have a broad basis, interfering with respiration and deglutition. When invading the bone, the latter enlarges decidedly. The actinomycotic growth may grow outward, break through muscle and skin, and appear as a mushroom-like mass, or the growth may take an inward course and appear in the mouth.

What forms of actinomycosis are observed?

External, internal and generalized—the latter very rare.

What animals are liable to actinomycosis?

Primarily, cattle; at times, horses, swine and sheep.

How are animals infected?

Usually through the ingestion of actinomyces-bearing food coming in contact with wounds of the mucous membrane of the mouth.

Describe actinomycosis of the bones.

Maxillary bones of cattle: The disease takes its start in the gums near a tooth, leading to an ossifying periostitis with formation of an exostosis. In those cases where the actinomycoma spreads to the marrow, a rarefying osteitis results. In both the ossifying periostitis and rarefying osteitis, the superior and inferior maxillary bones become greatly enlarged. After having invaded the bone, the actinomycotic granulation tissue may appear in the mouth, loosening teeth, or may even extend into the maxillary or frontal sinuses.

Of other bones, the following have been reported as actinomycotic : Sternum and ribs, vertebræ of the back and neck.

Describe actinomycosis of the pharyngeal cavity.

These soft tumors may resemble a polypus, being pedunculated, hanging from the mucous membrane ; are of pea to egg size, or they may have a broad base and be of fungoid shape. Similar neoformations are seen upon the mucous membrane of the larynx, trachea, vagina, intestines and nasal cavity.

Discuss actinomycotic lymph glands.

Those most frequently involved are the subparotid and submaxillary glands. Actinomycosis of lymph glands is never primary, but always of metastatic—that is, secondary,—origin. The gland enlarges, is firm, oval or round, and painless, varying in size.

Actinomycotic salivary glands are also seen occasionally.

Actinomycotic submaxillary lymph glands have been seen in the horse.

Discuss actinomycosis of the skin and subcutis.

More commonly seen about the head, udder, neck, abdomen, etc. They are both primary or secondary, the former arising from an infected skin wound, the latter from deeply seated actinomycotic processes which have broken through. They appear in the shape of nut to fist sized tumors, or as soft, reddish, fungoid masses. Fistulous openings may be present. Actinomycomata have been seen in castration wounds of pigs and in the spermatic cord of oxen and geldings.

Discuss actinomycosis of the mammary gland.

Those of the sow, where they are oftenest seen, appear as

pea-sized nodules, containing pus and detritus, the nodule being surrounded by a zone of firm connective tissue. Instead of the nodules, abscesses may be met with.

In the cow one or more quarter of the udder is hard, due to fibrous proliferations of the interstitial tissue, soft, pus-containing nodules being found here and there in the hyperplastic quarter. Actinomycosis of the whole udder is comparatively rare. Such an udder is hard and knobby, enlarged as a whole. When cut into, the surface exhibits numerous little yellowish spots, each spot containing a trifle pus.

Discuss actinomycosis of the muscles.

Statistics furnish one case where the elbow and shoulder muscles were actinomycotic. They are of metastatic origin, following skin actinomycosis.

Discuss actinomycosis of the tongue.

This form is quite rare in America, being quite prevalent in England and Germany. As a rule, the tumors are multiple, invading the whole organ. They produce marked induration, the result of severe connective tissue proliferation (Glossitis indurativa actinomycotica). Such a tongue is deformed, greatly enlarged and feels hard, for which reason it is termed "wooden tongue" in Germany. Somewhere upon, below or on the side of the tongue (usually the latter), one sees brownish spots, which are circumscribed, containing minute yellowish nodules.

In between the muscle fibres and beneath the mucous membrane are firm, fibrous actinomycomata of pea to nut size, which, when cut into, are seen to be filled with a cheesy, yellowish material. As a rule, the regional lymph glands show metastatic changes.

Actinomycosis of the internal face of the lips is character

ized by brownish actinomycomata. A very few cases of lingual infection in the horse are on record.

Describe the treatment of actinomycosis.

Those tumors which can be removed with the knife should be attended to in that way, otherwise the excellent results obtained by the specific action of iodide of potassium demands its employ.

BOTRYOMYCOMA

What is a botryomycoma?

An infectious new-growth caused by the invasion of botryomyces.

Under what other names are the botryomyces known?

Botryococcus, micrococcus bitryogenus, micrococcus ascoformans.

Do all investigators agree upon the botryomyces as the cause of botryomycomata?

They do not. Some claim that the micrococcus ascoformans is not a specific germ, but simply a pus coccus.

What is the nature of the botryomycoma?

This neoplasm, also termed mycofibroma, represents a chronic inflammatory connective tissue proliferation produced by the botryomyces.

What animals are subject to botryomycosis?

Primarily, the horse; occasionally, the ox and swine.

What mycofibromata are of interest to the surgeon?

Those in the skin and subcutis, muscles, mammary gland and spermatic cords.

Describe the botryomycoma of the skin?

They are either solitary or multiple, from pea-sized nodules up to man's-head size, the largest ones being almost always met with in the scapulo-humeral articulation and about the elbow. The tumor is of firm consistency, but may show soft portions here and there, with fistulous tracts extending into its interior. It cuts quite hard, the knife creaking as it passes through. The cut surface has a fibrous appearance, and shows here and there little cavities filled with a yellowish mucoid fluid and pockets filled with pus.

What cutaneous regions are principally involved?

All parts exposed to harness pressure, elbow, point of shoulder, tail, lips and fetlock.

Does the skin botryomycoma confine itself to the skin only?

The larger tumors of this sort after developing in the skin invade the deeper organs.

Describe the botryomycoma of the spermatic cord.

This condition is commonly termed scirrhus cord or champignon. At the time the animal is castrated, the castration wound becomes infected with the botryomyces and a funiculitis botryomycotica is the consequence. It sets in by not healing of the castration wound, which continues to discharge pus. Now and then an acute cellulitis follows, alarming the owner, who usually at this stage seeks professional advice. This cellulitis always sets in when the opening through which the pus is discharged closes up, to disappear as soon as a new perforation is established allowing the pus to escape. This condition may persist for years without leading to serious consequences. The spermatic cord as a whole, or only its distal end, shows a rather painless, hard swelling. The vaginal process and the cord and surrounding

tissues all form one solid mass, the skin at the most dependent part showing fistulous openings leading into tracts of various depths.

On section, the surface is grayish white, showing here and there softened foci containing a muco-purulent semi-fluid holding the botryomyces.

Describe the botryomycoma of the mammary gland.

This is of rather malignant disposition, very likely to recur after excision, and has a decided tendency to invade the surrounding tissues. The part of the udder involved feels hard and nodular; there may be fistulous openings and abscesses present, the affection occasionally spreading to the abdominal parietes and thigh.

Describe the botryomycoma of muscles.

These are quite often seen at a point where the mastoido humeralis covers the point of the shoulder, representing a form of the so-called shoulder abscesses. They differ but little from those described under botryomycoma of the skin. Other muscles in which they are observed are those of the belly, intercostal muscles. Botryomycosis of bones seems to be very rare. One case is on record where the tumor developed from the maxillary sinus. This tumor, springing from the mucous lining, became as large as a child's head in two months, causing a bulging of the maxillary and frontal bones, unilateral nasal discharge and nasal dyspnoea. Generalized botryomycosis has been described once; it was a mare, the primary point of infection being the uterus. Those botryomycomata found in internal organs have no practical surgical interest.

How do you treat botryomycomata?

They are best excised, carrying the knife well into the

healthy tissues to prevent recurrence. In case the mammary gland is involved, it is best to amputate the whole gland. The same is done with the scirrhus cord. Those cases where a multiple botryomycosis is present, are operated from time to time, as it would be out of the question to remove all neoformations in one sitting. More recently medication with iodide of potassium and external applications or injections of tincture of iodine are reported to have given very satisfactory results.

TUBERCULOSIS.

What is tuberculosis?

An infectious disease due to the presence of the bacillus of tuberculosis in the tissues of the body.

Is tuberculosis of the domestic animals of much surgical interest?

It is not, for various reasons. First, tuberculous disease of the external organs of animals is not of frequent occurrence. Second, those operations of great value in man, as, for instance, resection of a tubercular joint, are not to be thought of in animals. Third, those animals where tuberculosis is more frequently encountered (ox, swine) are for slaughter, the tuberculous lesions exhibited by them being either of a localized, external description, and then of little practical moment, or the lesions are secondary and the result of generalized tuberculosis, in which case they are incurable.

Which forms of tuberculosis are of practical surgical interest?

Tuberculosis of the mammary gland, lymph glands, skin and subcutis, mucous membranes, bones and joints, muscles, eye, testicles, brain and spinal cord.

Describe the tubercular mammary gland.

The diseased process consists either of a localized tuberculosis, tuberculous mastitis or diffused miliary tuberculosis. The bacillus rarely enters through the teat, thus creating a primary tuberculosis; in most cases it is of embolic origin—that is, secondary. Such an udder, of which usually the posterior quarter is at first diseased, shows a diffused, hard swelling, which is little painful, with enlargement of the regional lymph gland and supra-mammary lymph glands. As the disease advances, hard nodules develop in the swollen quarter; finally the whole udder may attain a large size and show the same symptoms just mentioned. In regard to the lacteal fluid, it must be said that in the earlier stages it undergoes no visible changes, only later it becomes watery and flocculent, containing the specific bacillus.

Describe tuberculosis of the lymph glands.

The affected lymph gland enlarges and becomes hard, explained by the process of calcification the tubercle undergoes and the proliferation of the interfollicular connective tissue of the gland. Infection of the lymph gland takes place both by the blood and lymph vessels.

Name the lymph glands most commonly involved.

Those in the intermaxillary space and those near the parotid gland, the retropharyngeal; those of the cervical region, the prescapular, axillary, and those near the elbow, the inguinal, popliteal and precrural, the supra-mammary glands. Of the lymph glands of the internal organs, the bronchial ones alone are of interest, as, by becoming enlarged, they may compress the œsophagus and produce tympanitis.

Describe tuberculosis of the skin and subcutis.

This is but occasionally seen in cattle. They appear at

first as swellings from nut to fist size, become soft and exhibit a cheesy material containing the tubercle bacillus. In the dog, ulcers on the neck involving the regional lymph gland have been observed.

Skin tuberculosis has been frequently observed as a primary lesion about the head, and here especially about the eye and commissure of the beak of the parrot. They are either soft tumors from pinhead to egg size, of globular shape, or skinhorn-like excrescences in the skin; tubercular ulcers containing the bacillus are also observed.

Describe tuberculosis of the mucous membranes.

In the shape of ulcers or mushroom-like mass, it is observed in the larynx and trachea of cattle. Upon the nasal mucous membrane of cattle one sees occasionally an aggregation of small, lardaceous looking nodules, which may become confluent and form an ulcer, there being also nasal dyspnoea and discharge. Uterine tuberculosis (endometritis caseosa tuberculosa) is not rare. In the parrot, tubercles and ulcers are seen upon the mucous membrane of the mouth and eye.

Describe tuberculosis of the bones and joints.

Tuberculosis of the bones is usually secondary, that is, it is caused by a tubercular embolism; therefore, starting in the marrow, an osteomyelitis granulosa is the result.

The bones more frequently involved are the temporal bone, sternum, cervical, dorsal and lumbar vertebræ, and ribs. In tuberculosis of the middle ear (otitis media and interna tuberculosa) in swine, the infection takes its origin in the pharyngeal cavity and reaches the cavity of the middle ear via the Eustachian tube, creating here a tuberculos osteomyelitis, next periostitis and rarefying osteitis, necrosis of the bone now reaching the meninges, and finally brain. In goats,

sheep and horses, tuberculosis of vertebræ and ribs has also been reported. In fowls, tuberculosis of the bones is not a rare occurrence.

Tuberculosis of articulations has been most frequently observed in fowls, that of the carpus and tarsus in swine; while in cattle, tuberculosis of the hip, stifle and knee joints are less frequently seen.

Describe tuberculosis of muscles.

This form is of little surgical moment, being, as a rule, of an embolic nature, therefore the result of generalized tuberculosis. They appear as brownish nodules, of pinhead to bean size, usually circumscribed and arranged in rows, the muscles usually involved being the abdominal, thigh and pectoral muscles. Tuberculosis of the tongue is seen in parrots and at times in cattle.

Describe tuberculosis of the eye.

This is also an embolic form, and of rare occurrence in the ox, attacking the iris and choroid, eventually destroying the eye and changing it into a cheesy or granulating mass.

Discuss tuberculosis of the testicles.

This leads to enlargement of the glands. On section, pea to nut sized tubercles are seen. Tuberculosis of the spermatic cord, tunica vaginalis and prostate gland have also been observed. All these are comparatively rare; those of the testicles are reported in the bull and boar, that of the prostate have been observed in the bull and dog. Tuberculosis of the ovaries seems to be quite frequent.

Discuss tuberculosis of the brain and spinal cord.

These are of interest from a standpoint of differential diagnosis, as they give rise to symptoms of paresis or

paralysis, while tuberculosis of the spinal cord may produce locomotor ataxia or paraplegia.

Describe the treatment of tuberculosis ?

Generally speaking, such patients are not treated, for obvious reasons ; while in disease of the testicles or ovaries castration or spaying may be attempted.

CONCRETIONS AND FOREIGN BODIES.

What is a concretion ?

A stone-like mass, a sediment of an earthy basis from retained secretions or excretions of the body.

Enumerate the concretions of surgical interest.

1. Renal calculi. 2. Intestinal calculi. 3. Salivary calculi. 4. Lacteal calculi. 5. Præputial calculi. 6. Rice kernel calculi.

Where do you find renal calculi ?

In the kidney, pelvis of the kidney, bladder and urethra.

What is their composition ?

Silicates, urates, triple phosphate, carbonate and oxalate of lime, etc.

How are they formed ?

1. As a result of disease of the renal mucous membranes, colloids (mucus, epithelium, blood, pus) are present. These colloids form a nucleus around which the earthy salts of the urine are precipitated, eventually becoming calculi.

2. Through the agency of bacteria, which, by producing an ammoniacal fermentation, bring about precipitation of triple phosphate.

Describe the urinary calculi of the various animals.

Horse : There are two kinds, those of the bladder and those in the urethra. Their composition is about the same, consisting of traces of iron, oxalate of lime and a greater amount of carbonate of lime. The vesical calculi are of nut to fist size, are hard, either egg or disc shaped, with a smooth or mulberry-like surface and of yellowish color. One or several stones, as well as a finer sediment ("gravel"), may be found. The urethral calculi are usually found at the ischial curvature and are of pigeon egg to chestnut size.

Cattle : These are composed of carbonate and oxalate of lime. As a rule, a number of round or disc-shaped pea-sized stones, glistening and yellowish, are found at the curve of the urethra.

Dog : These are usually small, of pea size and present in numbers. The surface may be rough or by continuous rubbing may have become smooth. They are composed of oxalates, urates and triple phosphate, filling the whole urethra, being wedged at the incurvated portion of the penial bone.

Describe intestinal calculi.

These are also known as enteroliths in the horse and are of little surgical interest unless they can be reached from the rectum. They are found in the caecum and colon, causing obstruction and colics. They are primarily composed of triple phosphate, formed by the precipitation of the phosphate of magnesia (coming from the food ; bran, for instance) by the ammonia found in any barn. The ammoniaco-magnesium phosphate and calcium phosphate—that is, the triple phosphate—crystalizes around a kernel of oats or any other foreign body, and the foundation to a calculus is laid.

In cattle the so-called hair balls are quite often found in the rumen. These are also called bezoars and are made up of

plant fibers or hairs. As a rule they cause no inconvenience, but may, when regurgitated, become lodged in the œsophagus and give rise to symptoms of choke.

Describe salivary calculi.

They are seen in horses and cattle, especially in Stenos duct. Single stones are of oval shape, while multiple ones are variously shaped as the surfaces which are in contact with each other are ground down. In the center there is usually some foreign body, as a bit of straw or an oat kernel, which forms the nucleus to the whole. They vary from pea to egg size and are composed mainly of carbonate of lime, some phosphate of lime and organic substances; they have a white to pale yellow color.

Describe lacteal calculi.

These concretions, found in the teat or milk cistern of the udder, are made up principally of carbonate of lime with some fat and casein. They are of variable shape, may become as large as a hazel nut and range in color from pale yellow to gray. Clogging the channel through which the milk is emptied, it becomes of surgical interest.

Describe preputial calculi.

These are observed in the urethral sinus of the penis and in the prepuce proper, the former being commonly termed "beans," which when attaining a certain size may obstruct the flow of urine. They are smooth, oval concretions mainly consisting of inspissated smegma.

Describe the rice kernel bodies.

These peculiar formations, also known as corpora libra, chondroids, are of organic origin, representing coagulated or inspissated or calcified products of inflammation or bits of

neoformations, bone or cartilage. They are found in the guttural pouches, tendon sheaths, bursæ and articulations.

How do you treat the various calculi ?

Urinary calculi are subject to operative measures—namely, by cystotomy and urethrotomy. Intestinal calculi in horses are, as a rule, beyond reach, if not beyond a positive diagnosis. Hair balls in cattle, when giving rise to choke, are treated as such. Salivary calculi are removed by opening the salivary duct and extracting the stone. The same refers to lacteal calculi. Preputial calculi can be easily removed by hand. The treatment of corpora libra is discussed under its respective head.

Foreign Bodies.

What are foreign bodies ?

Any irritant entering the tissues of the body from without.

In what parts of the body are foreign bodies of surgical interest ?

Buccal cavity, pharynx and œsophagus, stomach and intestines, respiratory apparatus, eye and ear, hoof, skin, subcutis, muscles, bones and internal organs.

Where do you find foreign bodies in the mouth ?

In, beneath and around the tongue, between the teeth, mucous membranes of the cheeks, palate, openings of the ducts of salivary glands.

What symptoms are they likely to produce ?

Ptyalism, chewing motions, quidding of food (difficult mastication), stomatitis and rabiform attacks (dogs).

Enumerate some of the foreign bodies met with in the mouth.

Splinters, needles, pieces of bone, fish hooks, rubber bands, sprouting seeds (a regular lawn was seen upon the face of the tongue of a cow). In the ducts of glands, bits of straw, kernel of oats, barley.

A dog is on record with a piece of metal in the Eustachian tube and a horse with a piece of straw, having worked its way up the lachrymal duct.

What animals are more commonly the subject of foreign bodies in the mouth ?

Dog, cat, cattle ; less frequently the horse.

What symptoms do foreign bodies of the pharynx and œsophagus produce ?

Difficult deglutition, pharyngitis and choke.

What foreign bodies are usually met here ?

In horses : Corn cobs, potatoes, turnips, apples, food boluses, pieces of a whip ; in the guttural pouches, accumulations of food.

Cattle : The above and also hair balls, tin cans, pieces of metal, cloth, pieces of afterbirth, bacon rinds, beefsteaks (given empirically as an artificial cud).

Dog : Bones, needles, fishbones, large pieces of meat ; in playful dogs, spools, stones, etc.

What serious sequels may these produce ?

Perforation of the pharynx, rupture of the œsophagus and consequent internal hemorrhage from injury of the aorta, or pleurisy.

What foreign bodies are seen in the stomach of cattle ?

An endless variety ; all the way from horse rake teeth down to needles, nails and stones.

What effect do they have upon cattle ?

As a rule they do not cause any inconvenience, only when sharp and long enough they perforate the wall of the organ holding it ; thus they perforate the diaphragm, pericardium, and injure the heart, causing serious disease of the digestion and heart (traumatic gastritis and pericarditis).

What foreign bodies are observed in the stomach and intestines of the dog ?

Bullets, balls, coins, spools, etc.

What symptoms do they give rise to ?

Sometimes none at all ; then again more or less anorexia, emesis, constipation, great restlessness, or great dejection ; in other words, symptoms suggestive of intestinal obstruction.

What foreign bodies are seen in the rectum and urethra ?

In the rectum of the dog any of the previously-mentioned foreign bodies may be seen ; in the horse, pepper, lumps of salt herring (introduced by empirics). In the urethra of the horse I found a piece of a catheter.

What foreign bodies are found in the respiratory apparatus ?

Accumulations of food in the maxillary sinus ; in the nasal cavity, food, sponges, cotton, etc., placed there by jibbers to hide nasal discharges of the horse. In the trachea, pieces of cartilage aspirated during tracheotomy, pieces of the tracheotomy tube, oil, especially when drenched through the nose.

What symptoms do they produce ?

Purulent nasal discharge, usually unilateral when the sinus is affected, or violent fits of coughing at first, with subsequent symptoms of a foreign body pneumonia in case the foreign body entered the trachea.

What symptoms do foreign bodies of the eye and ear give rise to ?

Eye : Depending on the nature of the irritant (bits of straw, hay seeds, etc.) and length of time they are present, the symptoms of a chronic purulent conjunctivitis are there, especially so in the horse when the foreign body is beneath the membrana nictitans.

Ear : The offending agent is usually a parasite, as lice or mange parasites.

What foreign bodies most commonly enter the hoof ?

Nails and glass.

What portion of the hoof is more frequently involved ?

The commissures of the frog.

What symptoms do they give rise to ?

Lameness, the result of pain due to pododermatitis.

Describe the actions and results of foreign bodies in the skin and in underlying parts.

Such foreign bodies may be bullets, shot splinters, etc. The most important feature lies in the fact whether they carry infection into the tissue which they enter or whether an aseptic wound is produced. Bullets, unless carrying bits of the harness or hair into the deeper parts, may become encapsulated, creating no further sequels. Those causing infection of the parts give rise to pus production, as abscesses or more or less serious cellulitis. Foreign bodies of animal origin and introduced by the surgeon (catgut) become liquefied and are absorbed.

Of what surgical interest is air as a foreign body ?

When animals are bled (phlebotomy), it is possible that

air may enter the vein and when of sufficient amount may produce death by arresting the heart.

Outline the treatment for foreign bodies.

Those in the mouth are simply extracted with the fingers or forceps. Those in the pharynx of horses and cattle I have frequently removed by directing a stream of water from a handpump against the wedged masses (with proper care and judgment). In the dog, they are removed with a forceps or an emetic (apomorphine). In the horse, sialagogues, as arecoline and pilocarpine, may also be used. Those which are in the œsophagus are pushed into the stomach with the probang (an easy thing in the ox but much more difficult in the horse). At other times œsophagotomy or modifications of that operation are indicated. Of course those cases where the pharynx or œsophagus are perforated are beyond remedy. Foreign bodies in the guttural pouches are best removed by Merrillat's operation (opening the pouch through the soft palate). Those in the stomach—that is, the rumen—of the ox may at times be removed by rumenotomy. Those in dogs, unless they come away with an emetic, or, if in the bowels, with a purge, may be removed by enterotomy, which when properly done is borne very well by the dog. Those in the respiratory apparatus (the nasal cavity) can be removed with the fingers or forceps. Those in the sinuses by trephining them. Those in the trachea are usually beyond reach. Those in the eye may be washed out with a soft rubber syringe or picked up with a forceps. Those of the ear usually require an antiparasitic treatment. Those of the hoof are simply pulled out when present and good drainage and antisepsis are employed. Those in the skin and underlying parts are removed when *in situ*, unless it is reasonable to presume that an aseptic process of healing is possible, as in some gunshot wounds.

Which foreign bodies of parasitic origin are of interest to the surgeon ?

In the horse : 1. *Filaria Papillosa*. Found in the anterior chamber of the eye, giving rise to iritis and keratitis. Treatment consists of operative measures. This parasite has also been found in cryptorchids and hydrocele. 2. *Filaria cincinnata*. Occasionally causes a tendinitis in Russian horses. 3. *Filaria medinensis*. Seen in the subcutis of horses in tropical countries, as East India, Africa, etc. It causes a form of elephantiasis (strongulus armatus). Has been found in the hypertrophied nasal mucous membrane. 4. *Sarcosporidia*. When present in great numbers give rise to an interstitial myositis.

In cattle : 1. *Cænurus cereбрalis*. Produces symptoms of brain disease, as vertigo, wobbly gait, blindness, even paraplegia. Treatment by trephining. 2. *Hypoderma bovis*. Forms nut sized tumors, each tumor representing an abscess containing the larva. Treatment: Split the abscess and squeeze out the contents.

In sheep : 1. *Cænurus cereбрalis*. Same as in cattle. 2. *Æstrus ovis*. Located in the nasal and maxillary sinuses, giving rise to a chronic catarrh of the mucous membranes of those parts. Treatment consists in blowing some mild irritant into the nasal cavity, or for those in the sinus by trephining, with subsequent irrigation of frontal sinus.

In swine : The *Cysticercus cellulosæ* has been found in the eye.

In the dog : 1. *Pentastomum tænioides*. In the nasal cavity and frontal sinus, causing a purulent rhinitis. Treatment : Trephine frontal sinus and inject benzine. 2. *Filaria medinensis*. In the subcutis, producing a form of elephantiasis in dogs of tropical climes. 3. *Spiroptera sanguino-*

Ienta. Seen in Java, producing cysts in the walls of the œsophagus.

HERNIA AND PROLAPSUS.

What is a hernia ?

A protrusion of viscera through normal and abnormal openings in the walls of the cavity holding it without injury of the skin or mucous membrane covering it.

Speaking of a hernia, what is ordinarily meant by it ?

A protrusion of the abdominal viscera through abnormal openings of the abdominal muscles.

What other kinds of hernia are spoken of ?

When a muscle protrudes through a rent of the fascia covering it, one speaks of a muscular hernia ; in the same way of hernia of the brain, lungs, etc.

In regard to position, what varieties of hernia are known ?

Umbilical, inguinal, ventral, scrotal, perineal, diaphragmatic, femoral, vaginal, pelvic.

Describe the make-up of a hernia.

(1) The opening in the abdominal cavity, termed the “mouth ;” through this protrudes (2) the sac with its (3) contents.

Describe the sac.

The sac is the pouch covering the bowel or omentum. That part external to the mouth of the hernia, or the main part of the sac, is termed the body, while the part constricted by the mouth is known as the neck.

Classify hernias according to the contents of the sac.

Enterocoele contains intestines only.

Epilocele contains omentum only.

Entero-epilocele contains both of the above.

Cystocoele contains the bladder.

Gastrocele contains the stomach, etc.

Name the clinical varieties of hernia.

1. Reducible. The contents of the sac can readily be returned into the abdominal cavity.

2. Irreducible. The contents cannot be returned, due to incarceration or inflammatory adhesions.

3. Incarcerated. The contents of the bowel form an obstruction to the return of the bowel into the abdomen.

4. Strangulated. An arrest of the circulation of the protruded bowel, due to severe constriction at its neck.

How are hernias classified as to their origin?

(1) Congenital; (2) acquired or traumatic.

Give the symptoms of a reducible hernia.

In the so-called hernial region (region of the umbilicus, inguinal canal) a swelling is found, which is soft, regular, round and smooth. As a rule, there are no symptoms of inflammation, as heat, pain, swelling of the adjacent tissues. The integument over the tumor can be displaced. The contents of the sac either slip from under the palpating fingers or have a doughy, uneven feel. In the former it contains bowels only; in the latter, omentum. Of course both may be present together. On placing the finger against the tumor and pushing it toward the wall of the cavity from which the tumor comes, the rent in the wall or the dilated state of the natural canal through which it came (inguinal canal)—that is, the mouth of the hernia—can be felt. This varies in

size, may be round or show a split. The edge of this mouth, in old hernias also termed the ring, has a firm, fibrous feel. In cattle this ring has been found ossified. The palpating fingers can reduce the hernia ; that is, can push back part or all of the contents of the sac into the abdominal cavity if the hernia be a ventral one. Percussion of the sac in case it contains bowels gives rise to a tympanitic sound.

Give the symptoms of an incarcerated hernia.

In the obstructed hernia most of the symptoms just mentioned above are present, but there is this difference : in the sac, doughy feces, gases and liquids can be felt, the tumor is larger than ordinarily and cannot be reduced by taxis. There is abdominal pain. In dogs and swine, besides these symptoms there may be slight vomiting. I have had two patients (geldings) for several years who invariably had nasty colics from incarcerated inguinal hernia whenever they were allowed to stand in the barn for a few days in succession. Both of these animals died subsequently, the post mortem examination revealing the fact that the incarcerated hernia had become strangulated, which diagnosis had been made at the time of their last illness.

Give the symptoms of strangulated hernia.

More often seen in old hernias than recent ones. In the horse—usually the stallion of mature age—they are ushered in with colicky symptoms. The hernial sac is painful on palpation, and shows increased heat and cannot be reduced. The tumor feels tense, the animal stretches same as they do before stalling, or take a dog-sitting position or show other symptoms suggestive of intestinal obstruction ; the pulse is rapid and soon becomes wiry ; the facial expression is one of great anxiety, etc.

Dogs and swine show abdominal pain, vomit ; symptoms of collapse soon follow ; otherwise the hernial tumor exhibits the same conditions as in the horse.

How do you treat a hernia ?

There are two methods : 1, palliative ; 2, radical.

Describe the palliative treatment.

Only employed in reducible hernia. Here by means of a truss the protruded mass is retained in its cavity, as a result of which sometimes the hernial mouth becomes so small that the gut no longer can protrude. This method is at times of value in young dogs, colts and brood mares. At the same time it must be remembered that in the young a hernia may disappear spontaneously, as the bowels quite rapidly enlarge and become too large to pass through the hernial mouth. Some practitioners advise the application of blisters and caustics, as sulphuric acid, the actual cautery. Others, again, advocate the hypodermic injection of a salt solution or alcohol—all with a view to produce artificially an inflammation and scar formation around the rent in the wall of the cavity from which the contents protrude. These latter methods are of doubtful value and not without danger, as it is known that the integument covering the hernial sac sloughs off, thus causing a prolapsus ; while the hypodermic injections have as sequels peritonitis and septic cellulitis.

Describe the radical treatment.

Unless the mouth of the hernia is too large (say, exceeds five inches in length), the hernial sac may be obliterated by tying it off by means of an elastic ligature, as a rubber tube or even a common string (do not apply it too tight or the skin will slough off too soon and a prolapsus may follow); or by stitching off the sac—that is, ligate it in sections. This latter

form I prefer. The above treatment has the advantage that the peritoneal cavity remains closed and the dangers of a peritonitis are done away with, and on the whole it can be looked upon as a safe and reliable means. The most surgical treatment is herniotomy. Here of course asepsis and chloroform narcosis are essentials, otherwise peritonitis is likely to follow. Herniotomy in the dog gives very nice results, while in the horse the nature of the tissues, as well as the difficulties accompanying asepsis, render it of doubtful value, at least in every-day practice. That herniotomy can be executed successfully in the horse, especially in the colt, has been demonstrated.

Give the treatment of incarcerated hernia.

Attempt to reduce the hernia by hand (taxis). If necessary, put the animal into the dorsal recumbent position, assisting it by exerting traction upon the gut from within, that is, through the rectum. In cases of inguinal hernia in the horse, since he most likely will have to be operated, put him upon the back and chloroform him ; abduct and bring well back the hind leg of the affected side. Should all this fail and the danger of strangulation become apparent or strangulation is already present, operate. Instead of widening the hernial ring with the knife right away, puncture the loop of intestine presenting itself with a fine trocar and canula, such as is found in our hypodermic syringe cases, thus allowing the escape of a considerable amount of gas and liquid. In this manner I have succeeded frequently in reducing a strangulated hernia. When this fails, split the hernial ring, and re-position of the sac's contents becomes easy. In stallions, this is to be followed by castration by the covered method, while in geldings the tunica vaginalis is to be searched for and dissected from the bowels, which usually

are connected with it by adhesions ; next the tunica is twisted once or twice around its axis and a small curved clamp applied over it as high as possible.

What varieties of hernias are more commonly met with in our various animals ?

Ventral hernia : Cattle and horses.

Umbilical hernia : Dogs and horses.

Inguinal hernia : Horses and swine.

Describe the individual hernias.

Ventral hernia : The causes are traumatic ones, such as kicks, falls upon blunt objects (tree stumps, etc.). The hernia may be located at any part of the abdominal parietes, usually about the flanks or along the linea alba. Their size varies, but may be very large. My experience with these ruptures is, that when the mouth of the hernia exceeds eight inches they are incurable. From a standpoint of differential diagnosis, at least in recent hernias, one must remember abscesses and hematomata. In small animals herniotomy gives nice results, while in the larger ones the clamp or ligature is preferable.

Pelvic hernia (gut tie): Seen in the ox ; mainly due to a peculiar method of castration, consisting of tearing the spermatic cord through or tearing it out by sheer force. In consequence of this the parietal peritoneum is lacerated and a pouch results ; an intestinal loop may enter it and become strangulated. There are colicky symptoms. By rectal palpation under right or left transverse process of the sacrum the constricting cord and incarcerated intestine can be felt. Treatment consists of laparotomy or re-position of the incarcerated loop by hand per rectum.

Umbilical hernia : Seen especially in young animals. Heredity seems quite an etiological factor ; the animal is

either born with the hernia or it appears soon afterwards. The contents of the sac are usually the colon or caecum. The mouth of the hernia is represented by the umbilical ring. On the whole, small umbilical hernias are of little consequence, often disappearing voluntarily, the bowels becoming rapidly too large to pass through the abdominal opening. For this and other reasons this variety of hernia rarely incarcerates. The treatment in younger animals should be an expectant one unless the hernia is large. In older animals and in large hernias of the young animal, operative measures are indicated, as herniotomy (in the dog and colt, in the latter only when the ligature or clamp has failed); in older and larger animals the clamp or ligature are safest.

Inguinal hernia: This may be looked upon as a dangerous hernia, as, by reason of its location, incarceration of a descended intestinal loop quite frequently occurs. It is of most interest in the horse, and productive of the symptoms of an obstruction colic. The treatment consists in herniotomy. After return of the intestinal loop into the abdomen the animal is castrated by the covered method, the tunica vaginalis being twisted several times around its axis. Now a small and curved clamp is placed over the tunica vaginalis and cord and placed as near to the inguinal opening as possible. An important feature lies in leaving the clamp in position as long as possible, in order to obtain adhesions between the cord and tunica vaginalis, thus preventing the intestines from descending.

Prolapsus.

What is a prolapsus?

A protrusion of viscera into the external air, through normal or abnormal openings of the body.

What is the difference between a hernia and a prolapsus ?

In the hernia, the integuments, as skin or mucous membranes, are not injured and the protruded viscera are not exposed to the external air, while in the prolapsus the integuments are injured and the viscera are in actual contact with the external air.

What two terms are often confounded with prolapsus ?

Inversion and invagination of a hollow organ.

What does inversion and invagination respectively mean ?

In inversion things are turned inside out ; for instance, in inversion of the bladder the organ is turned inside out, appearing externally through the urethra but not through a rent of the mucous membrane of the vaginal wall, as is the case in prolapse of the bladder. In invagination, one part of a hollow organ is drawn into another part ; in other words, the parts become telescoped.

Name the causes of prolapsus.

Traumatisms, as penetrating wounds extending into the abdomen or chest, resulting in prolapsus of the bowels or lungs ; lacerations of the vaginal walls, prolapse of the bladder, paralysis of the penis, prolapse of the penis, relaxation of the broad uterine ligaments, prolapse of the vagina or uterus, constipation and consequent severe straining by the muscles concerned in defecation, prolapsus of the rectum, etc.

Are all cases of prolapsus pure and simple those of a prolapse ?

They are not. In many instances it represents a combination of prolapse with invagination ; in other instances it is a prolapse with inversion.

Give an example of both.

Prolapsus of the rectum is usually a prolapsus of the rec-

tum plus invagination of the rectum. Prolapsus of the vagina is frequently not only a prolapsus of the vagina, but at the same time an inversion of that organ.

Describe the prolapsus more commonly encountered.

Prolapsus of the Intestines. Follows penetrating wounds about the abdomen. The protruding bowels are usually the large, the small colon or the caecum. Another cause is the castration of ridglings (cryptorchids) through the inguinal canal, the bowels prolapsing either immediately or shortly after the animal rises. Finally, the bowels may protrude after herniotomy has been performed. In all these cases, excepting perhaps the prolapse following herniotomy (provided proper aseptic precautions have been taken previous to the operation and afterwards), the danger of septic complications is great. The treatment consists in asepticizing the parts, thoroughly suturing the lacerated parts and application of a retention bandage wherever possible.

Prolapsus of the Omentum. Follows penetrating wounds and ridgling castration. The treatment is the same as in prolapse of the bowels, but there is decidedly less danger. The protruding mass of omentum is ligated and cut off, the stump returned into the abdominal cavity. Since it is practically impossible to stitch up the inguinal canal, I have had good results by firmly packing the cavity as high up the inguinal canal as possible with aseptic oakum and stitching the cutaneous wound.

Prolapse of the Rectum. Follows empirical exploration of the rectum, prolonged diarrhoea, constipation—in fact, anything calling the muscles concerned in defecation into excessive play. Quite rare in the horse, it is seen in the cat, dog, and especially swine. As previously stated, it is often combined with invagination of the prolapsed parts. The

treatment for prolapse of this sort is not always successful, as the parts will continue to appear externally, and amputation may become necessary.

Prolapse of the Uterus. Most frequently seen in the cow. It follows almost invariably anything which induces the animal to strain persistently, such as rough empirical traction during labor, the weight of the partly detached foetal placenta hanging from the vulva, etc. Sometimes considerable trouble is experienced in retaining the parts after they have been returned: so much so, that amputation of the uterus may be required.

Prolapse of the Vagina. Most frequently seen in the cow and bitch. As causes may be given relaxation of those organs which fix the vagina, as, at the latter stage of pregnancy, cows standing on floors sloping downward, difficult labor with traumatic lesions of the vaginal canal. The treatment consists in reposition of the parts and retaining them by a variety of trusses.

Prolapse of the Penis. In cases of paraphimosis the penis cannot be retracted and therefore becomes prolapsed; as also in paralysis of the penis. This form of prolapsus is most frequently seen in the horse and dog. The treatment consists in attempting reposition of the organ by hand, next by antiphlogistic measures, and when they fail, in amputating the prolapsed portion.

Prolapse of the Tongue. Follows paralysis or lacerations of the muscles. Treatment is unsatisfactory.

Prolapse of the Bulb of the Eye. Seen in large-eyed dogs, as pugs, following bites, etc. Treatment lies in reposition, or, in case the life of the tissues is destroyed, in amputation.

DISEASES OF BONES.**Fractures.**

What is a fracture?

A sudden forcible separation of the continuity of a bone.

What are the causes of fracture?

1. Exciting or immediate causes.
2. Predisposing causes.

Describe the exciting causes.

Fractures of this last class are subdivided into (a) fractures by external violence, (b) fractures by muscular action. In those due to external violence, as a blow, kick, etc., the fracture occurs at the point struck, or through transmission of the force by a bone or chain of bones at a distant point with more or less damage to the overlying soft parts. In those due to muscular action the bone is broken by sudden and violent contraction of muscles directly or indirectly attached to the bone. Again, those the result of external violence may be by direct violence or indirect violence; the former occur at the point struck, the latter at a distance from the point of application of the force, the blow being transmitted through a bone or chain of bones.

Exemplify the direct causes of fractures.

Direct external violence: Fracture of the metatarsus from a kick.

Indirect external violence: The animal falls and sits down like a dog, followed by fracture of some portion of the vertebral column. The animal's hoof is caught in a street

rail ; in trying to free itself the animal twists the incarcerated hoof, resulting in fracture of the os corona, etc.

Muscular action : Horses when cast in a narrow stall in their vain efforts to rise strain the muscles of the back to the utmost, executing at the same time all sorts of torsion movements, resulting in fracture of the vertebral column. A very similar thing is occasionally seen in the operating room ; horses when thrown for an operation will struggle violently when lying on the bed, calling into most active play the longissimus dorsi especially, as a result of which a fracture of the dorsal or lumbar vertebræ is observed. Fracture of the dorsal vertebræ has been seen to follow sudden rearing ; that of the lumbar vertebræ in animals turning quickly and short. Overtaxing the gastrocnemii or flexors of the knee has been followed by fracture of the calcaneus and pisiform bones respectively.

Describe the predisposing causes.

To this class belong the so-called idiopathic fractures. In these fractures the bones seem possessed of abnormal fragility ; a variety of fractures quite frequently seen in the horse and cow, especially in certain localities, osteoporosis, osteomalacia and tuberculosis apparently predisposing the animals to fractures. Old animals are predisposed by reason of senile atrophy, the very young by reason of their juvenile bones ; those that have been ill and in the barn for a considerable length of time are predisposed by reason of inactivity atrophy.

Anchylosis of the vertebral column is another predisposing factor.

How are fractures classified ?

1. Simple : there is no open wound leading to the break.

2. Compound : here an open wound leads to the broken bone.

Name the varieties of fractures.

(1) Incomplete, (2) complete, (3) compound.

Describe incomplete fractures.

This class is represented by fractures where the continuity of the bone is not entirely lost—that is, the break extends partially through the thickness of or partially across the bone.

As incomplete fractures are recognized :

(a) Fissure or fissured fractures. This consists of a crack or split in the bone. These are quite common in the horse and difficult of diagnosis ; met with usually in the os suffraginis and tibia.

(b) Green stick fracture. This is a true incomplete fracture. It is called “green stick” because the appearance of the injured bone is about the same as when a green stick is held at either end by the hands and broken across the knee, leading to a pulling apart of the fibres on the outside while the concave portion—that is, the one resting against the knee—is compressed. In the bone, therefore, a portion of its thickness is broken while the balance is bent. Only seen in the long bones and ribs of very young animals.

(c) Depression fracture : In these a portion of the thickness of a bone is crushed. This must not be confounded with a depressed fracture, where the entire thickness of the bone is crushed in. Usually seen about the cranial and facial bones.

(d) Strain fracture : Consists of the breaking off of a piece of a bone, due to violent contraction of a muscle, as the tearing off of a piece of the os calcis through strain upon it by the gastrocnemii.

Describe complete fractures.

The fracture extends entirely across or through the thickness of the bone.

How do you divide complete fractures according to the direction of the line of fracture?

Transverse: The break runs more or less at a right angle to the long axis of the bone. Generally caused by a direct force.

Oblique: The line of fracture runs obliquely to the long axis of the bone. Generally due to indirect causes.

Longitudinal: The line of fracture runs more or less parallel to the long axis of the bone.

Dentated or toothed: Each broken end exhibits sharp points and depressions; that is, it is serrated.

V-shaped: The upper fragment shows a triangular projection, while the other one exhibits a notch into which the triangular or wedge shaped projection fits.

T-shaped: Consists of an upper transverse or oblique line plus a vertical or longitudinal line of fracture. In the horse, most commonly seen in the os suffraginis.

What is a multiple fracture?

It is a complete fracture where either more than one bone is broken or where one bone is fractured more than once.

What is a comminuted fracture?

It is a complete fracture with considerable splintering of the bone where the lines of fracture communicate with each other.

Describe compound fractures.

In this fracture the overlying soft parts either were injured from without by direct violence or from within by

pieces of bone forcing themselves through the tissues; or, finally, the injury of the soft parts may be secondary, being the result of necrosis from the pressure of displaced bony fragments, rough handling, as an animal suddenly throwing excessive weight upon the broken limb on account of slings in which it rests or slipping, or the soft tissues injured during the accident, slough. This variety of fracture is always serious, mainly on account of the possibility of infectious complications, as tetanus, septicæmia, necrosis.

Transverse displacement: There is a complete or partial dislocation of the fragments at a right angle to their former normal long axis; that is, one fragment is either in front, behind or back of the other one, but they do not overlap each other.

Angular displacement: The fragments are dislocated at an oblique angle to their normal long axis; that is, the fragments form an angle with each other.

Rotary displacement: One or the other fragment is turned about its normal long axis.

Over-riding displacement: The broken surfaces overlap each other, thus bringing the two extremities of the broken bone more closely together.

Impaction displacement: The bone is shortened as the fragments are forced into each other.

Direct longitudinal separation: The broken parts are drawn apart in a longitudinal direction.

Which animals furnish the most fractures?

In the large cities, with their asphalt pavement, street car rails, slippery roads in winter, fractures in the horse are common; otherwise, kicks, running against solid objects, casting the animal, etc., are frequent causes. Next in frequency comes the dog; here bites, blows, falls and being run

over by wagons, etc., are the direct causes. Finally, birds and swine, and occasionally the cat, furnish clinical material.

Which bones are most frequently fractured in the horse?

Fracture of the pelvic bones, tibia and os suffraginis represent about one-half of all fractures, the other half being made up by the vertebræ, radius and metatarsus.

Which bones are most frequently broken in the dog?

The vast majority of fractures are those of the bones of the legs, only ten per cent. of all fractures being made up from fractures of such bones as the cranial, vertebral, ribs, scapula, sternum.

Which bones are most frequently broken in birds?

Mainly the femur, humerus and tibia.

Which points do you take into consideration in the diagnosis of a fracture?

1. The history, that of a fall, kick, bite, runaway, etc.
2. Diminished or lost function and pain. When the bones of the extremities are broken the animal supports very little or no weight at all and is moved with great difficulty. Loss of function, nevertheless, is not always marked, as, for instance, in certain fractures of the pelvic bones the animal can still support weight with the affected leg; in fractures of the ribs and in some fractures of the bones of the head there is also an absence of loss of function. Pain, as a rule, is well marked, exhibited on palpation; thus dogs cry out and the horse will endeavor to get the affected limb out of reach of the one conducting the examination. Complete loss of function accompanies fracture of the vertebral column, characterized by paraplegia and complete anæsthesia, normally enervated by that portion of the spinal column posterior to the point of fracture.

3. Abnormal mobility, usually in all directions. By it is understood an independent mobility of a part of a bone which normally is an unbroken structure. This is detected by inspection and palpation. While as a rule quite readily observed in complete fractures, it nevertheless is at times apparently wanting, as in fracture of the vertebræ or in those fractures where the fragments are driven into each other (impaction fracture) and in incomplete fractures.

4. Crepitation. By it is understood the peculiar grating sensation heard or felt due to the rubbing together of the broken surfaces. This symptom is pathognomic of a fracture best detected by palpation and passive movements of the ends of the bone supposed to be fractured. It is wanting when the broken fragments are very much displaced, in vertebral fractures and incomplete fractures.

5. Swelling. While quite often wanting in incomplete fractures, it soon follows other fractures, consisting of a swelling of the adjacent soft tissues, either due to the laceration of the tissues at the time the accident occurred, subsequent injury by the bony fragments, or septic inflammation. Swelling often greatly handicaps the diagnosis of a fracture, obscuring such symptoms as abnormal mobility and crepitation.

6. Injury of the skin may or may not be present, while in older fractures abscess formation fistulous tracts are seen.

7. Constitutional disturbance. Rise of temperature may be due to the absorption of ferment-like materials coming from the disintegration of the blood corpuscles at the point of fracture, being an aseptic fever and slight. In complicated fractures, as the result of the invasion of pus-producing bacteria and the consequent absorption of the septic material, a septic fever of variable intensity and seriousness results.

Sometimes symptoms of internal hemorrhage are seen, the hemorrhage being the result of injury of a large blood vessel by the sharp bony fragments, occurring at times in pelvic fractures (obturator artery).

What individual symptoms are of specific value in the diagnosis of fractures?

Epistaxis, nasal dyspnoea and depression of the nasal bones are peculiar to fracture of the nasal bones. Pneumonia, pleurisy and hemoptysis may follow fracture of the ribs. Paralysis of the tongue, difficult deglutition and mastication as well as loosened teeth are met with in fracture of the hyoid bone, respectively maxillary bone. Fracture of the cervical vertebræ may give rise to paralysis of the diaphragm. Fracture of the cranial bones may be followed by paralysis of the brain.

What points do you take into consideration in the diagnosis of incomplete fractures?

A positive diagnosis of these is not always possible, this referring especially to the so-called fissured fracture, quite commonly seen on the os suffraginis and tibia and less often on the os corona and vertebral column of the horse.

The essential features upon which the diagnosis in these cases is based are: sudden intense supporting leg lameness (for detailed descriptions, see my "Clinical Diagnosis of Lameness in the Horse"), with a history of external violence. (This symptom does not hold good in cases of fissured vertebræ, where the horse sometimes works for days without showing any loss of function at all.) There is usually volar flexion of the phalanges, but no change in form or abnormal mobility of the parts. In one to two days after the accident there is more or less oedematous infiltration of the overlying

soft tissues. The individual disposition toward pain varies greatly in animals; in some it is impossible to palpate the limb, while others hardly react. Twisting of the fissured bone and pressure upon certain parts produce more or less pain. Theoretically, there ought to be distinct pain along the line of fracture; in practice this may occasionally be detected, but on the whole such fractures can only be diagnosed by the train of symptoms and the history of the case and by a systematic and thorough examination for all those conditions which have symptoms similar to those of a fracture; in other words, the condition can be forcibly surmised by a diagnosis by exclusion.

What points are of importance in the prognosis of fractures?

1. Economic reasons. While a fracture may be curable, economic reasons may forbid the treatment. Therefore, in each case the first question is, Does it pay the owner to have this fracture treated? If not, the slaughter of the animal should be suggested.

2. The animal species. In the horse and cattle, treatment of fractures is tedious, because it is often very difficult and sometimes impossible to adjust dressings to the broken ends of the bone which hold the fragments in place. Continuously resting upon three legs or the recumbent position may be complicated by laminitis (comparatively rare) or by decubitus and subsequent sepsis. Fractures in cattle and horses heal in about one to three months; in the dog, in three to four weeks; in birds, about fourteen days.

3. The broken bone itself is of great importance. Thus, in the horse and cattle, fracture of the vertebræ with injury to the spinal cord, and, as a rule, both simple and complicated fractures of the femur, tibia, scapula, humerus and radius, certain pelvic fractures and comminuted fractures of the os

corona and suffraginis, are incurable. Fractures of the metacarpus and metatarsus stand a slightly better show. Finally, treatment may be attempted in fractures of the processes of the vertebræ, simple fracture of the os pedis, os corona, suffraginis, ribs, external angle of the ilium, facial bones.

4. The variety of fracture is equally important. Comminuted and complicated fractures and those involving a joint or its neighborhood are, as a rule, not treated. Old fractures and those where marked displacement of the fragments is present are unfavorable, for this reason. Transverse fractures are more favorable than oblique ones. Simple fractures and fissures are more favorable than complete ones. Fractures near joints may lead to an ankylosis and therefore chronic lameness.

5. The age of the animal is important, for economic reasons and also because the process of healing is much slower in old than in young animals.

The prognosis of fractures, especially to the beginner, offers many difficulties. The following examples may be of some service to him :

1. High-priced carriage horse (gelding), of good age, with fissure fracture of the os suffraginis. It will take from six to twelve weeks to heal the fracture. As the result of bony deposits along the fissure there are good chances for a chronic lameness, which may be relieved by neurectomy provided there are no articular complications. Inform the owner of these points and the approximate expense connected with the treatment of the animal. If you have yet to make a reputation, call on some brother practitioner of established reputation and business integrity to assist you ; then let the owner decide.

2. Running horse (stallion), good age ; oblique fracture of the metatarsus. Prognosis favorable for a cure, but animal will be unfit for the race track ; useful for breeding purposes only. If the owner is satisfied to use him in the stud, go ahead with your treatment.

3. Trotting mare, due to foal in five days ; fracture of the shaft of the ilium. Perform Cæsarean section and try to save the foal, because the mare is most likely doomed as a breeder and may abort as the result of the accident.

4. Cow, in calf four months ; fracture of the floor of the pelvis. If this cow is a fine butter or milk cow, let her finish her period of gestation, and then remove the calf by performing embryotomy. In this way the owner will have the use of that cow for another year, when she ought to be sold for fat beef. If the cow is but a common scrub and in the above condition, advise immediate slaughter.

5. Pet dog ; comminuted fracture of the metatarsus. Owner wants the life of his favorite saved, no matter what the expense. Amputation below the tarsus most likely the only chance in this case. Try to impress the owner with the fact that a dog with three legs only is a burden to himself and all those about him. If he or she—it is usually a she—persists, operate. More than likely the animal will be at your office within a year or so to be chloroformed.

6. Gelding, 13 years old ; a little sore in front ; splendid worker. While going to the blacksmith fell on his left hind leg ; got up quite lame ; was put back into the barn and a veterinarian called at once, who diagnosed a fracture of the femur, and advised to kill the animal. This horse being the first one the owner ever bought, he thinks a great deal of him and orders the barn man to feed "old Jim" one more good square supper and that he will have him shot in the morning.

In the morning the barnman reports "old Jim" eating well, very lame, and quite a swelling about the region of the hip, whereupon the owner concludes to call another veterinarian for an opinion and his choice falls upon you. The owner meets you, gives you the history of the case, most likely omitting the diagnosis of your predecessor, and says: "If the leg of this horse is broken, I want to have him shot, as I don't want the old fellow to suffer any longer." Inspection simply shows a swelling in the region of the hip joint. This swelling is painful and hot. The leg is rested upon the toe, the horse drawing the leg up once in a while. Palpation from the stifle joint down is negative. Pulse, 48; respirations, 18. Mucous membranes slightly congested. Temperature, 101.2 deg. F. When backed out of his stall he hops on three legs. The history of a fall followed by sudden severe lameness causes you to suspect a fracture. Now you palpate the pelvic bones per rectum, at the same time having his leg twisted, brought forward, backward and abducted. You imagine you perceive a faint crepitus. After finishing your examination, what can you honestly say? What facts has your systematic and careful examination revealed? The owner wants a positive answer one way or the other. This is a case where nobody can positively diagnose a fracture; there are simply some indications to that effect. Tell the owner that since the decisive symptoms of a fracture are wanting and your examination is greatly handicapped by the large swelling, it preventing you from making a close examination of the underlying parts, you suggest an antiphlogistic treatment—(don't use the latter term, because he would most likely not understand the word "antiphlogistic")—for four to five days, at the end of which time you will re-examine the horse.

HEALING OF FRACTURES.

How do aseptic fractures heal ?

The process of repair is closely related to the healing of an aseptic skin wound. The blood which has been effused as result of the injury is presently absorbed and has nothing to do with the process of repair. The periosteum and bone marrow and soft parts undergo an aseptic inflammation, exudation occurs, and a mass of embryonic tissue—that is, granulation tissue—is the result. This granulation tissue, at first soft, subsequently ossified, glues the fragments together, so to speak, and is termed the callus, and the bone once more becomes a solid structure.

What varieties of callus are concerned in the healing of fractures ?

1. The external callus, developing from the bone-producing cells (osteoblasts) of the deeper layers of the periosteum.

2. The internal callus, developing from the bone-producing cells (osteoblasts) of the marrow.

3. The intermediate callus. It lies between the fractured ends and is composed partly from the external, partly from the internal callus.

What is a provisional callus ?

The soft, spongy tissue at first forming around and between the broken ends ; it is the result of the action of the osteoblasts.

What is a permanent callus ?

This is the provisional callus, having undergone ossification. In other words, it represents a bone scar formed mainly through the agency of the osteoclasts.

What is the difference between the provisional and permanent callus ?

Both are the same product of a process of regeneration, only in different stages of development.

What are osteoclasts ?

These are multinuclear giant cells supposed to have the power to form free carbon dioxide and thus dissolve the lime salts of the bones and absorb bony substance.

What is a synostosis ?

The permanent union of two single parallel bones by a callus ; for instance, in fracture of two adjoining ribs.

What is an ankylosis ?

A stiff joint. Here the articulating extremities of two bones are rendered immovable by a callus.

What is a fibrous callus ?

One which, instead of being composed of bone, is made up of fibrous tissue. In other words, the callus never reached a higher development than the fibrous stage. Seen in fractures of bones with limited blood supply, insufficient immobilization of the fragments and in those where the fragments were drawn apart to considerable extent : false ribs, patella, pisiform bone, olecranon, etc.

What two processes is the ossification of the callus the result of ?

It is the result of an ossifying periostitis and osteomyelitis.

What is a pseudoarthrosis ?

It represents an ununited fracture ; that is, the broken ends show mobility, being held together by fibrous union ;

there may be a fibrous capsule, which after some time may secrete a serous fluid for lubrication of the broken ends of the bone, which may be smooth and eburnated and possibly covered by hyaline cartilage, in this instance forming a new joint.

Describe the process of ossification of a callus.

The ossification of the granulation is either a direct or indirect one. The former is the result of direct ossification by the osteoblasts of the periosteal and myelogenous granulation tissue (the embryonic tissue following inflammation of the periosteum and marrow). In the indirect process of ossification of the granulation tissue, this latter first becomes cartilage, which in turn becomes bony tissue. About the third or fourth day after the fracture occurs, little foci of osteoid tissue exhibit themselves at the point of fracture (due to the action of osteoblasts). In the second week the external callus is still soft; by the end of the third week the periosteal callus consists of pretty firm, spongy bone. The internal callus undergoes the same changes.

In four to five weeks the provisional callus begins to be converted into a permanent cicatrix (permanent callus), the superficial and deeper portions of the provisional callus become absorbed—mainly by the action of the osteoclasts; finally, the medullary cavity of the bone is more or less restored and the surface of the bone shows but little of the large ovoid mass, the original callus.

How is the regular callus formation interfered with?

By constitutional diseases, as osteoporosis, osteomalacia, infectious diseases, by marked displacement of the bony fragments, infection of the tissues at the point of fracture, decided splintering of the bone; by the lodging of soft tissues between

the broken ends, continuous mobility of the broken ends (insufficient immobilization).

How do complicated fractures heal?

The seriousness of a complicated fracture lies in the amount of splintering of the bone, and especially the age and amount of injury to the skin and neighboring soft parts. Complicated fractures where the skin wound can be aseptically healed almost as rapidly as a subcutaneous—that is, aseptic—fracture.

In the complicated fracture the callus formation is the same as in the subcutaneous fracture, but is greatly interfered with as the result of those conditions which are sequels of an infection, namely: purulent cellulitis, retention of pus, lymphangitis, necrosis of the soft parts and bones, purulent periostitis and myelitis, formation of fistulæ and general sepsis, as septicæmia and pyæmia.

How would you testify in Court in a case of this sort?

A horse was sold by A to B and warranted by A as sound and true in all harness. In the morning after the purchase the horse is down and unable to get up. You are called and diagnose complete fracture of the tibia and order the horse killed. Post-mortem examination reveals a soft external spongy callus at the line of fracture. Your certificate therefore will state that the animal was unsound at the time of purchase suffering with a fissured fracture of about two weeks' standing. Had the fracture occurred during the night at the new owner's stable, there would be no osteoid tissue present, that is, no callus, but simply an effusion of blood and symptoms of a fresh aseptic inflammation.

How do you treat simple fracture?

1. By reducing the fracture. This means that the sur-

geon restores the displaced fragments to their normal position or as close to it as possible

2. By retaining the fragments in position.

How is a fracture reduced ?

1. By extension ; that is, the surgeon exerts steady traction upon the lower fragment.

2. By counter-extension. This means the fixing of the upper fragment.

3. By coaptation, by which is understood the adjustment of the fragments to their proper position.

Why are these steps necessary ?

Absolute rest to the broken bone and proper adjustment of the fragments are essential to the normal development of a callus.

Can you reduce the fractures in all animals this way ?

In the dog and other small animals, as a rule. The larger animals offer great difficulties. In such fractures as those of the pelvis and ribs, the reduction of a fracture by extension and counter-extension, etc., is out of the question; also when fragments of bone get between the ends when muscles are pinched in, when the broken bones can't be grasped or fixed.

Why do you employ extension and counter-extension in reducing a fracture ?

It is done to overcome the contraction of muscles and the elasticity of fasciæ, tendon, etc.

How do you proceed for this purpose ?

The smaller animals may be given a dose of morphine and are then laid upon a table, where, with the help of one or two assistants, the upper fragment is firmly held, while

another person steadily pulls upon the lower fragment, as much as possible in the direction of the normal axis of the broken bone, while the surgeon adjusts the broken fragments to their proper position. In the larger animals, chloroform is best. Given in the horse, morphine is contraindicated, as its after effects (the horse gets restless) are detrimental. Of course before the animal is laid down it will be necessary to temporarily dress the broken parts to avoid further injury as he is laid down. Sometimes extension, counter-extension and reduction can be effected simply with the aid of a nose-twist. In practicing extension in the horse it is at times necessary to make use of pulleys to overcome the resistance offered by the elasticity of muscles, tendons, etc.

How can you tell that the limb is properly reduced ?

Take into consideration the position of the hoof or toes, as the case may be, and the length of the limb.

How are the broken fragments retained in proper position ?

In both horse and dog, I consider the plaster of paris bandage the best means.

How do you apply the plaster of paris dressing ?

Unless considerable swelling is present, a permanent dressing is applied as follows: Wrap around the affected part a thin layer of cotton; place over it a flannel bandage and over this the plaster of paris dressing. In the horse it is not necessary to apply the first layer—that is, the cotton.

How do you treat a recent simple fracture with considerable swelling of the adjacent soft parts ?

Here a permanent dressing cannot be applied, therefore a temporary one should be used, consisting of padding the parts with cotton, placing over this a flannel bandage; the

broken parts being besides this braced by stays or splints of binder's board, wood, or in the horse, band iron, such as is used in barrel hoops, held in place by the flannel bandage. Such a part is now kept moist with evaporating lotions until the œdematous state has disappeared, enabling one to apply a permanent dressing at the end of the third to the fifth day of such treatment.

What precautions do you take in applying a plaster of paris dressing?

1. Apply the plaster bandage uniformly and not too tightly.

2. Watch the skin and parts at the lower end of the plaster dressing for any swelling; when this shows—in other words, when œdema of the lower parts occurs—ease the dressing, in case of a temporary one, or remove it and apply a new one in case of a permanent dressing.

3. In dogs, it is essential to apply a cotton padding to all projecting parts to be covered with the plaster dressing, as the pressure continuously applied to the skin by the dressing would lead to gangrene and constitutional disturbances. Should necrosis of the skin really set in, treat the parts antiseptically.

4. Immobilization of the fractured bone being a requisite, envelop the joints above and below the point of fracture with the dressing wherever possible. The shape of certain parts renders it very difficult to securely apply a plaster dressing, as, for instance, in the forearm or thigh, the dressing here having a tendency to slip down; in these instances, run the plaster bandage over the back, forming a saddle, so to speak, this latter holding the dressing in place, preventing it from slipping.

What other precautions are necessary to secure healing of a fracture ?

Keep the animal quiet. Put the horse into a narrow stall and in slings, provided these do not irritate him. It is sometimes wonderful how a colt or horse, when turned into a box stall after his leg is properly set, will nurse it. The judgment of the surgeon is decisive here.

How soon can you remove the permanent plaster of paris dressing ?

In the horse, in six to twelve weeks ; in the dog, in about four weeks ; and in birds, about fourteen days.

How can you encourage callus formation by internal medication ?

Give horses once daily one-quarter to one-half grain of phosphorus ; the dog, 1-200 to 1-100 grain.

If you throw a horse for an operation and he breaks a bone at the time, what prophylactic steps must you take previous to throwing him and while throwing him to escape a verdict of guilty in case the owner of such a horse sues you for damages ?

Three classes of horses demand our attention here : the highly-bred horse (runners, trotters, etc.), the highly-fed draft horse and the old horse. The first two are likely to fight and wriggle around viciously as soon as they are laid down, subjecting themselves to fractures and a struggling myositis ; the last one—that is, the old horse—is predisposed to fractures of the vertebræ by reason of ankylosis and senile atrophy of the vertebral bones.

Whenever possible, operate the old horse in the standing posture and only lay him down when absolutely necessary.

The following plan, of course altered according to circumstances, has given me splendid results :

The horse which is to be laid down is given an aloetic purge, providing that his condition permits it. The day he enters or when at the home of the owner he is given a liberal water diet and fed a moderate amount of bran mash and no hay. The second day he is given an armful of hay in the morning and one bran mash in the evening ; as a rule, they do not care to eat very much anyway on account of the aloetic purge. On the third day he is operated, not getting any food but a little water when to be operated in the morning, or a bran mash for breakfast and some water at dinner when to be operated in the afternoon or evening. Of course modifications must be made to meet the various conditions of the patient and of the surgeon's practice.

The animal is to be thrown upon a soft bed and in a place affording sufficient space and light. The throwing harness should have a belly-band and a halter, by means of which the animal's head can be checked up sufficiently to prevent undue curving of the spine. In other words, the head and neck ought to be stretched out nicely when it is down. Undue lateral motions with the haunches and head are overcome by having someone hold the head properly and someone sitting upon the hip region. In case of all painful and prolonged operations the animals must be chloroformed, otherwise local anæsthesia is indicated.

Will such precautions relieve the surgeon of all responsibility?

Fractures will occur even under these circumstances, as experience teaches that the throwing of horses is not without danger to the animal.

How do you treat complicated fractures ?

Formerly compound fractures necessarily were looked upon as exceedingly dangerous accidents, but antiseptic surgery has taught us how to disinfect a wound and thus reduce septic dangers to a minimum. The treatment of compound fractures differs radically from that of a simple or subcutaneous fracture, by reason of the fact that the former is complicated by a wound and therefore exposed to septic sequels. The *sine qua non* in the treatment of a compound fracture is exhaustive disinfection of the wound of the soft parts and drainage when necessary.

1. When the wound of the integument is small and clean, disinfect it ; set the fracture, apply an antiseptic dressing to wound and over it place the plaster of paris bandage.

2. When the fracture is complicated with decided laceration of the soft parts, bony fragments perforating the skin or a joint open, disinfect every nook and corner of the wound, trim the sharp points of the bony fragments, ligate bleeding vessels, cut away contused tissues, remove foreign bodies, etc. ; make counter-openings for drainage, arrange the bony fragments, suture the cutaneous wound as far as possible, previously tamponing the wound cavity with iodoform gauze, and apply a temporary dressing, changing it at regular intervals. The plaster of paris bandage in these cases is to be applied as soon as the wound is healed.

3. Fractures with septic infection—that is, those older than one or two days—are also “purified” and best treated by continuous irrigation, applying such a temporary dressing as will permit of limited disturbance of the bony fragments.

4. Fractures where the parts are simply ground to pieces or those where the dangers of a general infection is marked. Thorough disinfection is to be tried, and when insufficient,

as a last resource, amputation of the affected parts is necessary.

When are the above principles applicable in veterinary surgery?

The veterinarian is occasionally called upon to extend such treatment to pet dogs, or larger animals which on account of their value as producers are worth the expense of such a treatment.

Which fractures in the horse are of special interest to the practitioner?

1. Fracture of the external angle of the ilium. Inspection: Rounded appearance of that portion of the pelvis, swinging-leg lameness. Palpation: No crepitation, and absence of external angle of ilium, as the bony fragment is drawn down and inwards. Prognosis favorable. Time required, four to six weeks.

2. Fracture of the shaft of the ilium. Inspection: Swinging-leg lameness, possibly swelling of that half of the pelvis. Palpation: Crepitation, usually by rectal examination or by placing one hand over the region of the hip and the other one against the ischial tuberosity and causing the horse to step over. Prognosis doubtful.

3. Fracture through the obturator foramen. Inspection: Supporting-leg lameness. Palpation: Crepitation on rectal examination. Prognosis doubtful.

4. Fracture of the pubis. Inspection: Supporting-leg lameness, possibly swelling under the belly (scrotum, udder). Palpation: Crepitation, not always detectable. Prognosis doubtful.

5. Fracture of external branch of the ischium. Inspection: Little or no lameness, region of hip joint bulges out.

Palpation: Crepitation, usually pronounced. Prognosis doubtful.

6. Fracture of the tuberosity of the ischium. Inspection: Swinging-leg lameness; before swelling sets in, the affected region appears broader, later there is swelling, involving rectum and vagina. Palpation: Crepitation more or less marked. Prognosis doubtful.

7. Fracture in the cotyloid cavity. Fractures through or close to the symphysis pubis almost invariably demand an unfavorable prognosis (for details, see my work on "The Clinical Diagnosis of Lameness in the Horse").

8. Fracture of the os suffraginis. Due to jumping and missteps, sudden turning, slipping, etc., the fracture may be a complete or, as is quite frequently the case, only a fissured one. Inspection: Supporting-leg lameness, possibly deformity and abnormal mobility. Fissured fractures, while causing severe lameness, still permit the animal to support some weight. Palpation: More or less crepitation and abnormal mobility; artificial rotation produces great pain. In fissured fractures, palpation along the extensor pedis tendon may elicit a painful line, switching off to one side or the other (usually the outer one). Prognosis: In complete fractures, doubtful; in fissured fractures, healing with a plaster of paris dressing may occur in six to eight weeks.

9. Fracture of the os corona; fracture of the os pedis. The same rules, generally speaking, apply to those as given under fracture of the os suffraginis.

10. Fracture of the femur. Due to falls, drawing the hind leg up as high as the elbow when tying the animal for operations. Lameness is severe. Crepitation usually well marked, also abnormal mobility. Prognosis is unfavorable,

unless it be simply a fracture of the trochanter, when it is favorable.

11. Fracture of the tibia. Often the consequence of kicks upon the internal aspect of the limb; it may follow also a fissured state of the bone, a complete fracture being the result of the lying down and rising or working of the animal. The symptoms of a complicated fracture are most common. Crepitation and abnormal mobility. Fissured fractures are difficult to diagnose; when there is good reason to suspect one, treat as such.

12. Fracture of the vertebral column. May follow a previous fissured state or occurs when down and unable to get up, as the result of excessive action of the ileo psoas and longissimus dorsi (excessive upward curving of the back) or from excessive bending of one side only. As a result of the injury to the spinal cord by the fractured bone, paralysis sets in, the animal is unable to rise and does not react to needle pricks. When happening during an operation, a peculiar crunching sound is heard; otherwise I have never been able to detect crepitation or abnormal mobility. Prognosis is unfavorable.

13. Fracture of the ribs. Due to blows of some sort. Those following kicks are often complicated fractures. Inspection may reveal a depression or swelling. Palpation: Pain; crepitation is rarely detected, but a crackling sensation, due to subcutaneous emphysema, may be observed. Pleurisy, pneumonia, pneumothorax, etc., are likely to follow perforating fractures. Prognosis: In simple fractures, which are often only surmised, it is favorable, and four to six weeks' rest are sufficient; in complicated fractures it is at times doubtful, and when not followed by death, fistula of the ribs may remain.

14. Fracture of the inferior maxilla. Of doubtful prognosis are transverse fractures of the branches of the bone, mainly characterized by more or less crepitation, abnormal mobility, swelling, disturbed mastication. Fractures through the union of the branches at their inferior extremity usually heal in one month.

Describe the most important fractures in the dog.

1. Fracture of the scapula. Follows falls and being run over. Parts most frequently involved are the neck and coracoid process. Prognosis is favorable.

2. Fracture of the humerus. Usually involves lower third of bone. The prognosis of subcutaneous fractures is usually a favorable one. The plaster of paris bandage, in this as well as in fracture of the scapula, should be run around the chest and over the back like a saddle to prevent slipping and to immobilize the parts properly.

3. Fracture of the radius and ulna. In most cases both bones fracture at the same time and mostly at the lower third. In solitary fractures of the ulna the olecranon is usually the part that breaks. Unless the fracture is badly complicated, the prognosis is favorable. While not absolutely necessary, I prefer to saddle the back with the plaster of paris bandage in these cases.

4. Fracture of the carpus is usually a simple one and has a favorable prognosis.

5. Fracture of the metacarpal bones occurs usually at the middle or lower third. Unless seriously complicated, they have a favorable prognosis.

6. Fracture of the phalanges. These are usually complicated, being mostly the result of the animal being run over. Prognosis even here is good, as the smashed toe is easily re-amputated, not interfering with the animal's usefulness.

6. Fracture of the pelvic bones. The most common cause consists in being run over, also kicks, falls, etc. The shaft of the ilium, its external angle and region of the cotyloid cavity are quite frequent, while of course the other pelvic bones are also, but less commonly, found fractured. There may be paralysis as well as the other symptoms peculiar to fractures. Prognosis is doubtful or unfavorable.

8. Fracture of the femur. This fracture heals less kindly, it being difficult to immobilize the parts, requiring at least four weeks. Most fractures occur at the lower third, next comes the upper third and finally the middle third of the bone.

9. Fracture of the tibia and fibula. This one has a more favorable prognosis than that of the femur. The part involved is usually the lower third of the bone.

10. Fracture of the tarsus, metacarpus and phalanges. The metatarsus usually breaks in the upper and middle third; the tarsus is less often fractured, while the phalanges exhibit mostly a complicated fracture. In these, the same rules hold good as in the corresponding bones of the forelegs.

11. Fracture of the inferior maxilla. This one, as well as fractures of the bones of the head, is quite rare. The fractures of the inferior maxillary bones more commonly are found at the union of the inferior extremity of the branches (prognosis favorable); further, in the region of the canine tooth. Transverse fractures of this locality are often difficult to treat and may require excision of the bony fragment.

12. Fracture of the vertebral column. These are, on the whole, seldom encountered excepting those of the coccygeal vertebræ, the treatment of which consists in amputation of that part of the tail. Being almost invariably the result of being run over, or getting pinched in between a door, the

cervical and lumbar vertebræ are those most exposed to fractures, which, leading to paralysis, leave no hope for a successful treatment.

13. Fracture of the ribs. Usually more than one rib is broken. A favorable prognosis can be offered unless such complications as pleurisy or pneumonia are present or to be expected. This fracture exceeds in frequency those of the vertebral column.

14. Fracture of the sternum. Seems to be exceedingly rare.

Inflammation of Bone.

From a practical standpoint, which are the most important structures involved in bony inflammations?

The most important is the periosteum in animals; next, the osseous tissue proper; finally, the marrow.

How do you term inflammation of the periosteum, bony substance and marrow?

Periostitis, osteitis, osteomyelitis.

Do inflammatory processes of bones differ materially from those of soft parts?

They do not, since the osseous tissue exhibits no material difference from the soft parts, practically speaking, being soft parts rendered firm by the addition of lime salts. For this reason injuries and diseases of bones are, on the whole, of like character and run about the same course as similar injuries and diseases of soft tissues.

Depending on the course of the disease, what variety of inflammations are considered in bony inflammations?

These inflammations run either an acute or chronic course.

Depending on the cause of the disease, what variety of inflammations are considered in bony inflammations?

The causes may be traumatic (due to external assaults), specific (as tuberculous, glanderous, etc.), hematogenous (originating in the blood), septic and aseptic, primary and secondary.

Periostitis.

What is periostitis?

Inflammation of the highly nervous and vascular fibrous membrane covering the bone, termed periosteum.

What forms of periostitis are of interest to the surgeon?

1. Acute, aseptic or traumatic periostitis.
2. Chronic ossifying periostitis.
3. Acute purulent periostitis.
4. Chronic purulent periostitis.
5. Chronic fibrous periostitis.

Describe acute aseptic periostitis.

This form of periostitis is the result of contusions, blows, as kicks, interfering, pressure from the bit upon the interdental space, or is seen as a consequence of simple subcutaneous fracture, and, as the name indicates, runs its course without the presence of pus producing bacteria in the affected tissues.

What are the symptoms of acute aseptic periostitis?

The periosteum being highly endowed with nerves, palpation elicits decided pain and circumscribed doughy swelling. When affecting bones of the extremities, there is lameness, or when involving the interdental space of the lower jaw, the animal will not tolerate the bit, is more or less head shy, etc.

How do you treat these cases?

Rest to the parts; when possible, warm moist applications, blisters.

Describe chronic ossifying periostitis.

In this form the products of inflammation become ossified, showing that the inflammatory process mainly involves the deeper layer of the periosteum—that is, the osteogenous layer inhabited by the osteoblasts; the form is a sequel of acute aseptic periostitis playing such an important rôle in the callus formation of a simple fracture.

What are the causes of chronic ossifying periostitis?

Repeated traumatic irritation of the periosteum.

What are the symptoms of this form of periostitis?

In due time a bony growth appears, variously known as osteophyte, exostosis; previous to the full development of this bony deposit there is pain on palpation, more or less doughy swelling, possibly lameness, etc.

Which bones most commonly undergo chronic ossifying periostitis?

The bone most commonly affected is the metacarpus of the horse; here the exostosis is termed a splint and appears almost invariably between the small and large metacarpal bones on the internal face of the shin bone; the exostosis about the tarsus is known as spavin. Animals with certain malpositions of the limbs are predisposed to a chronic ossifying periostitis, leading to a bony growth termed a “periarticular ringbone.” In these cases the periosteum is continuously irritated by being tugged upon by the ligaments of the joint, the result of the faulty position of the hoof. A similar explanation holds good in splint formations. In

chronic alveolar periostitis the tooth becomes united to the alveolar wall, rendering extraction at times very difficult. In horses suffering with chronic bursitis intertubercularis, bony deposits upon the humerus are found.

How do you treat ossifying periostitis?

By blisters and the actual cautery, and when they fail, by neurectomy.

Describe acute purulent periostitis.

In this form, pus-producing bacteria enter the periosteum from without—that is, through a wound of the overlying soft parts, as, for instance, in complicated fractures; or the bacteria reach the periosteum from within, as in purulent myelitis; or the infectious agent gets to the periosteum through the blood current, the periosteum in such a case representing a secondary or metastatic focus.

How do you treat these cases?

By incision and antiseptic irrigations and dressings.

What is a subperiosteal abscess?

An abscess formed under the periosteum, the result of a purulent infection of the marrow (purulent osteomyelitis). Its treatment consists of incising the abscess and antiseptic injections.

Describe chronic purulent periostitis.

In complicated fractures this form of periostitis, a sequel to acute purulent periostitis, is quite frequently seen, therefore, in complicated fractures of the ribs, pelvis, etc., as also in injuries to the interdental space by pressure from severe bits and curbing, in alveolar periostitis. Fistulous tracts are the consequence, because this form of periostitis leads to necrosis of bone and as the result of this to fistulous states,

the dead piece of bone keeping up the irritation and thus furnishing active material for a purulent discharge.

How do you treat chronic purulent periostitis?

This depends on the parts involved. Thus, in alveolar periostitis with empyema of the maxillary sinus, the sinus is trephined and the offending tooth removed. In other instances an incision is made down upon the diseased structures and the necrotic bit of bone removed by curetting, etc.

Describe chronic fibrous periostitis.

In this form a fibrous callus is formed, which by its pressure leads to atrophy of the underlying bone. In this instance the inflammation involves the upper layer of the periosteum, which, not being equipped with osteoblasts, can not ossify the products of inflammation, being a chronic connective tissue proliferation pure and simple. Its most common seat is right on top of the nasal bones, the result of pressure from the noseband of the bridle.

Inflammation of the Osseous Tissue.

Which histological structures does inflammation of the osseous tissue involve?

The Haversian canals, spaces and canaliculi.

What course does osteitis usually take?

Almost invariably a chronic course.

What are the causes of osteitis?

The most frequent causes are pressure and contusions; specific ones, as tuberculosis, actinomycosis, complicated fractures, the extension of inflammation from some other structure: for instance, from the marrow or periosteum.

What forms of osteitis are of interest to the surgeon ?

(1) Rarefying osteitis, (2) ossifying osteitis, (3) fungous osteitis, (4) deforming osteitis.

Describe rarefying osteitis.

This form of osseous inflammation is also known as osteoporosis. It is a degenerative osteitis, and usually the result of intensive or infectious processes ; it may exist alone or in combination with ossifying osteitis—that is, certain centers may exhibit a rarefying osteitis while the adjacent bony tissue undergoes an ossifying osteitis. Rarefying osteitis serves also to limit infectious processes, and further, to expel necrotic bone.

Describe the changes taking place in the osseous tissue in rarefying osteitis.

Following the inflammation there is an exudate. This exudate enters the Haversian canal, spaces and canaliculi; proliferation of the cellular elements takes place and thus embryonic tissue formation. As the result of the action of the osteoclasts, the bone undergoes rarefaction—that is, thinning ; granulation tissue becomes more and more abundant, gradually taking the place from which the bony substance has been removed by the osteoclasts. The solution and removal of the bone does not occur uniformly, but irregularly here and there.

Describe ossifying osteitis.

This form of bony inflammation is also known as osteosclerosis. It is the opposite of rarefying osteitis, as it represents a regenerative process and is usually the result of slighter and continuous—that is, chronic—irritations. Ossifying osteitis serves to render denser and stronger bony tissue

which has been weakened by previous disease. The inflammatory process being rather sluggish, a process closely resembling physiological bone-growth is observed. It starts mainly from the Haversian canals, these becoming narrower and consequently the bone denser and stronger.

Name examples of ossifying osteitis.

It is seen in the development of the spavin, in the final changes of the callus of a fracture.

Describe fungous osteitis.

This accompanies specific diseases, such as tuberculosis, glanders. Tuberculosis of bones is of hematogenous origin. The infected granulations are exuberant, often being of a fungoid nature. Osteomyelitis and caries are always present.

Describe deforming osteitis.

This represents a chronic inflammatory process, leading to an unnatural form or shape of the bone involved, due to softening, hypertrophy, etc.

Give an example of deforming osteitis.

The spavin.

Osteomyelitis.

What forms of osteomyelitis are to be considered ?

Ossifying and purulent myelitis.

Where is ossifying osteomyelitis seen ?

In fractures.

When is purulent osteomyelitis seen ?

In complicated fractures and infectious diseases, as in tuberculosis, for instance, or when pus-producing bacteria invade the bone marrow. In these two instances it is of

hematogenous origin; that is, the infectious agents are brought to the marrow by the blood current.

Which form of osteomyelitis is the more common one?

Purulent osteomyelitis.

Describe the changes taking place in osteomyelitis.

At first the marrow appears dark red, due to hyperemia; this is followed by absorption of the fat cells of the marrow, thus changing the yellow marrow into the juvenile or red marrow, which either organizes into bone tissue, filling the medullary canal as in callus formation of fractures, or when infected undergoes suppuration. In this case the adjoining bone tissue becomes involved and a rarefying osteitis is the result. As soon as the infectious material reaches the periosteum it is irritated by the infectious agent and an ossifying periostitis with subsequent exostosis follows, to be destroyed by the rarefying osteitis. As a result of this the ossifying periostitis becomes a purulent periostitis, the neighboring soft parts become infected, an infectious cellulitis ensues, and the pus thus eventually reaches the external world.

Give examples of purulent osteomyelitis.

It is seen in the interdental spaces of the horse as the result of pressure from severe bits in pullers; also in connection with alveolar periostitis in diseases of the teeth.

Necrosis of Bones.

What is necrosis of bones?

Death of the whole bone or part of the bone.

Name the causes of bone necrosis.

It is usually the result of a disturbed circulation of the blood caused by (1) traumatism, (2) inflammation.

How do traumatisms produce necrosis ?

Suppose that an animal is kicked and a complicated fracture the result. Bony splinters in such a fracture are no longer supplied with nutriment, as their blood supply is interrupted. Being a complicated fracture—that is, one infected by pus-producing bacteria—these bony fragments become necrotic. In subcutaneous bone wounds, or, for that matter, bone wounds which are not infected—that is, in an aseptic state—small bone splinters will be absorbed.

How does inflammation produce necrosis ?

Most commonly necrosis follows infectious inflammatory processes which may either arise in the bone or invade it from adjoining tissues. The former, for instance, are represented by purulent periostitis and osteomyelitis as seen in the interdental spaces of horses bitten severely or inclined to pull, or in the latter it reaches the bone by continuity ; for instance, in severe inflammation of the pododerm the os pedis—that is, a portion of it—may undergo necrosis. In severe phlegmonous states of the muscles and fasciæ overlying the dorsal vertebræ, as is seen in fistulous withers, some parts of the vertebræ may undergo necrosis, etc.

What do you understand by caries ?

The slow death of a part of a bone with softening, solution and partial absorption of the same, almost invariably due to specific infections, especially tubercular osteomyelitis and osteitis. It is a form of necrosis.

What do you understand by necrotic caries ?

The separation or expulsion of dead bony fragments of a carious bone.

What is dental caries ?

Seen at times in the molar teeth of the horse, it represents a progressive destruction of the dentine and cement of such a tooth.

How is dental caries produced ?

When the enamel of the tooth is injured, destructive agents (bacteria, decomposing food) enter and exert their pernicious influence upon the dentine and cement substance.

Is there any difference between dental caries and alveolar periostitis ?

Decidedly. They are two entirely different pathological processes, as dental caries may eventually lead to alveolar periostitis, but alveolar periostitis can never produce dental caries, at least in the sense in which caries is here, according to modern views, employed. Dental caries usually starts at the crown of the tooth, working upward toward the root, while alveolar periostitis begins at the periosteum of the alveolar cavity and root of the tooth.

Do all authors accept the above definitions of necrosis and caries ?

Most modern authors on pathology recognize the above definition as compatible with progressive medicine, while some authors yet understand by necrosis destruction of bone in mass, while by caries is understood by them molecular death of bone.

Why is the definition of caries, "Molecular death of bone," incorrect?

According to recognized teachings of to-day the cell is the unit of life and not the molecule. Consequently, it is only a cell or a group of cells which can die, and not the molecule. Of course by the misnomer "molecular death" those employing this faulty combination mean to say that death of a small portion of an organ has taken place.

What forms of necrosis are of practical interest?

(1) Superficial, (2) deep.

What is a sequestrum?

A piece of dead bone surrounded by living tissue.

Describe the process of sequestration in deep necrosis.

A necrotic piece of bone is a foreign body and thus acts as an irritant to the adjacent tissues, in this instance healthy osseous tissue surrounding it. Necrosis of bone and gangrene of soft tissues are analogous; in a similar way as soft gangrenous tissues are cast off soft healthy tissues by a line of granulations, the so-called line of demarcation, a line of granulation springs up around and close to the necrosed bit of bone as the result of a granular osteitis. Now the salutary effect of a rarefying osteitis makes itself felt by dissolving and loosening the dead piece of bone from the healthy bone, giving the necrotic piece at the same time a worm-eaten appearance upon its surface; while this is going on an ossifying periostitis and osteomyelitis develop around the site occupied by the dead piece of bone. Consequently new bone in the shape of an envelope forms, encasing the loosened piece of necrosed bone. This bony case containing the sequestrum and, of course, pus, is termed involucrum. This involucrum now is attacked by

the rarefying osteitis, which destroys it here and there, making openings into it through which the pus and sequestrum may be gotten rid of. The openings in the involucrum, the result of the rarefying osteitis, are termed cloacæ. In time the soft tissues surrounding the sequestrum may undergo gangrenous changes and the pus and bony fragments reach the external world at the point of least resistance, at which moment a fistula is established.

What is an exfoliation?

A superficially located sequestrum, the result of a superficial necrosis.

How do you treat bone necrosis?

The essential feature consists in the removal of the necrotic fragment. For this purpose the chisel, the curette or the trephine may have to be employed. As a rule, caustic injections and even the actual cautery are less desirable.

Atrophy of Bone.

What is atrophy of bone?

A decrease in size of the bone without change in its osseous structure.

What forms of bone atrophy are recognized?

1. Concentric : The thinning progresses from without to within, as a result of which the diameter of the shaft becomes lessened.

2. Excentric : The thinning progresses from within to without.

Give examples of atrophy of bones.

In sheep the cranial bones may become thin as paper as the result of the pressure upon the bone by the cœnurus cere-

bralis; by pressure from keraphyllocele upon the os pedis the latter wastes. The pressure of an aneurism against the vertebral column produces thinning of the latter, etc.

In chronic lameness, such as from spavin or ringbone, not only wasting of certain muscles sets in, but also an inactivity atrophy of the metacarpus or metatarsus.

Senile atrophy of bones leads to fractures of the vertebral column when aged horses are thrown for operations.

In such diseases as actinomycosis and osteoporosis, osteomalacia, etc., an inflammatory atrophy is seen as a sequel to a rarefying osteitis, the atrophic changes being the result of the action of the osteoclasts.

Hypertrophy of Bone.

What do you understand by hypertrophy of bone ?

An increase in size of the bone without change in the osseous structure.

What forms of bone hypertrophy are recognized ?

1. Exostosis : It represents a circumscribed hypertrophy. This neoformation has no sharply defined boundaries, but gradually merges into the osseous tissue from which it springs.

2. Osteophyte : Also represents a circumscribed hypertrophy, being just as much the product of an ossifying periostitis as the exostosis, but its boundaries are sharply defined and the osteophyte makes the impression as if it could be readily separated from the bone from which it springs.

3. Hyperostosis : Represents a diffused hypertrophy ; in other words, a larger bone area is involved in the hypertrophic change.

4. Osteosclerosis : Represents a hypertrophy arising in the marrow of the bone, while those previously spoken of originate in the periosteum.

What is Leontiasis ossea ?

This represents a congenital hypertrophy where the facial and cranial bones are hypertrophied. Seen in horses (so-called bull heads) and in dogs.

Rachitis (Rickets).*What is rachitis ?*

A constitutional disease, primarily characterized by softening and distortion of the bones of young animals.

What are the causes ?

They are obscure. Some authors claim a specific infection ; others heredity, unhygienic conditions, a deficiency of earthy salts in the food, etc.

Describe the changes taking place in the rachitic bone.

There is chronic hyperemia of all the bone-forming tissues. The periosteum thus exhibits thickening in the bone-forming layer, giving the bone a thick and heavy appearance. The tissue proliferation arises in the osteogenous layer of the periosteum, remains soft for a long time and is late to calcify. The insertion of muscles are the best places to observe these periosteal proliferations. An insufficient amount of lime salts in the excessively developed cartilage at the epiphyseal line, as well as the indiscriminate distribution among one another of medullary tissue bone and cartilage, is a peculiarity. These changes do not confine themselves to the epiphyseal line, but may render the shaft of the bone distorted and soft that it may be cut with a knife.

What are the characteristics of a rachitic bone ?

Abnormal development at the epiphysis near articulating surfaces, distortion of the long bones and vertebral column,

bones of the head, a row of beaded enlargements at the union of ribs and costal cartilage, etc.

What symptoms does the living rachitic animal exhibit ?

The animals more commonly exhibiting this disease are swine ; next dogs, birds, and more rarely the colt and calf. The creatures appear poorly nourished, they walk stiffly, may stagger and tire easily. The knee, hock, stifle, fetlock may be swollen and is tender on pressure.

How do you treat rachitis ?

Establish hygienic conditions by changing food, stabling, etc. Prescribe a tonic treatment and phosphorus; horse, from $\frac{1}{2}$ to 2 grains ; dog, 1-20 to 1-120 grain.

Osteomalacia.

What is osteomalacia ?

A constitutional disease of grown animals, characterized by softening and fragility of the bones.

What animals are most exposed to it ?

Mainly cows yielding a great deal of milk.

What are the causes of osteomalacia ?

They are obscure. It is met with on high and low lands when fed the best of food or when succulent and watery on calcareous soils and those deficient in lime. The three theories as to its nature at this day are :

1. A process of decalcification of the bones pure and simple.
2. A chronic inflammation of the bone.
3. Infectious disease.

Describe the changes in an osteomalitic bone.

The pelvic bones and those of the limbs are of special interest. In the beginning, there is simply hyperemia of the affected bone, small hemorrhagic foci being noticeable on section of the bone. As the disease progresses the hyperemic state becomes marked, the bone on section exhibiting bloody extravasation in the marrow and red punctation on the bone. When the disease advances yet more the bone becomes soft. The bone cells are replaced by fat cells. In short, the bone tissue degenerates until it becomes medullary tissue; the latter, increasing in bulk, becomes fatty, taking the place of bone tissue proper.

Outline the symptoms of osteomalacia in the living animal.

Perverted appetite, general depraved appearance. The creatures lie down a great deal, they are hide bound, the animals walk stiffly. In well advanced cases, fractures, distortions of the bones of the pelvis and legs are common.

How do you treat osteomalacia?

Change the diet to one rich in lime, give phosphorus with oil in doses of from 2 to 3 grains for cattle. In man the removal of the ovaries and testicles has given splendid results in the treatment of osteomalacia.

Osteoporosis of the Horse.

What is osteoporosis?

It is a rarefying osteitis, a form of osteomalacia peculiar to the young and adult horse.

What are the causes?

They are obscure. A great many facts point toward a microbian origin, the pathogenic bacterium either acting as

the irritant by directly invading the system, or a toxic agent enters some way or other. I have seen hundreds of cases in the South, but do not believe in a direct contagion. I think that accessory causes, by interfering with bone nutrition, predispose the creature to succumb to an invasion by a pathogenic germ, or some other toxic agent; as such accessory causes may be mentioned unwholesome stables, as are frequently met with in cities, faulty food, etc. While this disease has been frequently observed in the large cities, I have seen but three cases of osteoporosis in the past five years in Milwaukee, and two of these horses came to the city suffering with the disease, while the third, a pony, was in town about one year before my attention was called to its "big head."

Describe the symptoms of osteoporosis.

Its beginning is often insidious. As a rule, the animal soon becomes fatigued, sweats easily and has a poor and irregular appetite. Or the animal is brought to you on account of a lameness. The vast majority of cases seen by me were either shoulder, hip or stifle lame. Other animals are stiff, experience difficulty in lowering the head, walk stiffly, stumble easily, the long bones of the extremities may enlarge. Synovial distention about the various joints is an early symptom. A close study of the bones of the face usually shows in the earlier stages of the disease a rounded state—that is, a bulging of the nasal and superior maxillary bones; and when one hand is rested upon the nose and the other hand against the chin, now making lateral motion with the lower jaw—that is, grating the teeth upon each other—a dull, muffled sound is produced. Fractures and distortions are common.

How do you treat osteoporosis?

A change of climate gives the best result, even if it

be no more than placing the animal into another barn; good food, lots of sunshine, no undue exposure or excess of work, bone dust and small doses of phosphorus are valuable adjuncts.

DISEASES OF ARTICULATIONS.

Arthritis.

What is arthritis?

Inflammation of a joint.

What structures of a joint may be affected in arthritis?

The most important one is the synovial membrane. This is a serous membrane encapsulating the joint and analogous to the peritoneum or pleura. When inflamed it is termed synovitis. But the inflammation of arthritis does not only confine itself to the synovial membrane, but may involve the bone, cartilage, ligaments and tissues about the joint.

Depending on the cause of arthritis, what forms are recognized?

Traumatic, septic, infectious and aseptic arthritis.

What other forms of arthritis occur?

Arthritis the direct result of an assault is termed primary. When the sequel of a contagious inflammation, it is known as secondary. It is termed hematogenous or metastatic when the irritant is carried there by the blood, as in infectious diseases; viz.: contagious pleuropneumonia, septicemia, etc.

According to the course of the disease, what forms of arthritis are established?

Acute and chronic arthritis.

What is polyarthritis ?

That state where several joints are inflamed at the same time, as in rheumatism, pyemia, etc.

What is monarthritis ?

That state where only one joint is inflamed.

What is specific arthritis ?

An arthritis the result of a specific infectious disease, as glanders, tuberculosis, etc.

What is periarthritis ?

Inflammation of the tissues surrounding a joint.

How do you classify arthritis from a clinical standpoint ?

Serous arthritis (arthritis serosa).

What is serous arthritis ?

Inflammation of a joint with a serous exudate into the joint cavity.

What two main forms of serous arthritis are known ?

Acute and chronic.

What are the causes of serous arthritis ?

Contusions and distortions, certain diseased states, as retention of the afterbirth, rheumatism.

Describe acute serous arthritis ?

Usually the result of a distortion or contusion of a joint leading to an aseptic inflammation, especially of the fetlock, hock and stifle ; followed by increased heat, decided pain and circumscribed fluctuation about the joint.

In serous polyarthritis due to articular rheumatism there is in addition to the above symptoms also a decided elevation of the temperature of the body.

What becomes of the exudate poured into the joint cavity as the result of a serous arthritis?

It is either absorbed, or, when remaining, chronic serous arthritis is the consequence.

Describe chronic serous arthritis.

It is either found in joints predisposed to it by heredity (the joint is of a sluggish disposition and limited assaults affect it readily), or the sequel of an acute serous arthritis. This condition, also termed galls, is common in the hock, stifle and fetlock joints of colts. As a rule, this condition does not interfere with locomotion; the symptoms of an acute serous arthritis are present minus painful states and increased heat about the affected joint.

How do you treat acute serous arthritis?

Rest is essential. In the earlier stages cold applications, bandaging; later, a warm moisture by Priessnitz fomentations, iodine tincture or blisters are indicated.

How do you treat chronic serous arthritis?

Most any treatment is unsatisfactory, as blisters and even the actual cautery usually give negative results. From time to time favorable reports reach us in regard to the treatment of these conditions by incision of the joint with subsequent antiseptic irrigations. Such treatment, while possible and of great value in man, and which, under favorable circumstances, may be used in the smaller animals—as the dog—nevertheless is, to say the least, a rather hazardous undertaking in the horse by reason of the possibility of a secondary infection, which is practically an equivalent to a death verdict.

Purulent Arthritis (Arthritis Purulenta).

How is purulent arthritis produced ?

Pus producing bacteria may reach the joint via the blood current, as in pyemic polyarthritis of calves and colts, or a purulent inflammation of the soft tissues surrounding a joint may extend into the joint by contiguity, or, as is more commonly the case, pus producing bacteria are carried into the joint through a wound perforating the joint.

Describe purulent arthritis.

There is high fever and great constitutional disturbance. Pain and heat and a diffused swelling about the joint are marked. In those cases where a penetrating wound was the cause of it, a purulent synovial discharge (opaque, straw color) is seen. Periarticular abscesses may be observed in any case of this sort.

Is purulent arthritis a serious condition ?

Decidedly. In the horse these cases are soon complicated with septicemia or septicopyemia, rapidly causing death, especially when the larger joints, such as the stifle or hock, are infected.

In case recovery should set in, what changes take place in a joint previously affected with purulent arthritis ?

Anchylosis of the joint will be the result.

How do you treat purulent arthritis ?

For economic reasons, at least in the larger animals, as the horse, no treatment is attempted. The indications are to puncture the joint, aseptinize it, and keep it so by continuous irrigation. In the dog, resection of the joint or amputation can be practiced.

Deforming Arthritis (Arthritis Deformans).

What is arthritis deformans?

It is a chronic aseptic arthritis characterized by a permanent and material change of the shape and structure of a joint.

What are its causes?

Usually a traumatism, as contusions or distortions. Heredity—that is, a predisposition to it—plays an important rôle; chronic articular rheumatism.

Describe the changes taking place in arthritis deformans.

The disease usually starts in the articular cartilage. The cartilage cells proliferate, thus robbing the cartilage of its firmness. At the point where the articular surfaces come in contact—that is, rub each other—the cartilage is ground down more and more until eventually the epiphyses of the bones touch each other, the balance of the hyaline cartilage—that is, that portion not in actual contact with each other, but more or less free at the margin—also proliferates, forming excrescences. That portion of the periosteum covered by the synovial membrane where the latter is fixed to the margin of the joint also undergoes inflammatory changes by contiguity, as the result of which subsynovial exostoses are formed, readily seen or felt, and according to their location variously termed spavins or ringbones. The synovial membrane may in time become thickened as the result of the inflammatory process, this being especially the case at those points where it is fixed to the articular margins. Inflammatory changes, such as thickening of the connective tissue ligaments about the joint, as well as an ossifying periostitis, may become a natural consequence of the inflammatory process originally

•

started in the hyaline cartilage of the articular cartilage, gradually extending to these structures.

What are the terminations of arthritis deformans ?

The pathological changes just described either advance to such an extent that the joint becomes useless or a more favorable termination sets in by synostosis.

How does arthritis deformans terminate favorably by synostosis ?

To begin with, this only occurs in joints with limited motion, as in the tarsus and carpus. The favorable termination lies in the fact that the articular surfaces, bared of their hyaline cartilage by the diseased process, become fused—that is, ankylosed. In such joints as the hip or stifle the free motion prohibits ankylosis ; such animals therefore remaining cripples.

What articulations are mainly exposed to arthritis deformans ?

In the horse, the hock joint, where the exostosis is known as spavin ; the carpus, the stifle joint, the hip, the latter especially in the dog, cattle and more rarely in the horse.

Is the spavin always the result of a true arthritis chronica deformans ?

To be the result of a true chronic deforming arthritis, the pathological lesion must start in the articular cartilage of a joint. No doubt some spavins take their origin from this point. The classical histological studies by Gotti at the same time show that in many spavins the primary pathological lesions originate in the osseous tissue, and as the result of this primary osteitis a secondary chronic deforming arthritis sets in. This happens as follows : At first there is an osteitis

of the cuneiform medium and magnum and metatarsus ; this osteitis by contiguity involves the articular cartilage in the inflammatory process, and a chondritis—that is, inflammation of the cartilage—with subsequent proliferation of the cartilage cells, softening, etc., results, which now leads to a chronic deforming arthritis. Another way is this : There is at first an osteitis of the cuneiform medium and magnum, the overlying periosteum inflames and ossifying periostitis with its product, an exostosis—that is, the visible spavin with ankylosis of the articular surfaces—follows. The correctness of Gotti's claims have stood the tests of repeated investigations, also aided by the fact that in many spavins both the articular cartilage and periosteum are normal. The above applies equally well to ringbones. In periarticular ringbones no arthritis at all is present, but we have to do with an ossifying periostitis, the latter taking its origin at the point of insertion of the phalangeal ligaments.

How do you treat arthritis deformans ?

By rest, blisters and the actual cautery.

Of less importance from a surgical standpoint are the following forms of arthritis :

Describe fibrinous arthritis (arthritis fibrinosa).

The serous exudate in this form of arthritis contains an excess of fibrin, as a result of which a slight crepitation can be obtained by palpation. Ankylosis of the articular surfaces is a frequent sequel.

Describe panneous arthritis (arthritis pannosa).

A chronic arthritis met with in chronic articular rheumatism and old galls, the articular cartilage being covered with vascular granulations which in time bring about fibrous adhesions, or, in other words, a fibrous ankylosis.

Describe dry chronic arthritis (arthritis chronica sicca).

Quite frequently seen in horses and dogs. It is characterized by a fibrillary degeneration of the intercellular substance of the cartilage, followed by proliferation of the cartilage cells, which, breaking down, its surface exhibits an eroded, worm-eaten appearance. As the result of the pressure and rubbing motion by the epiphyseal ends of the bones, the cartilage becomes thinner and thinner until eventually the bone, deprived of its articular hyaline cartilage, is exposed. This form of arthritis is observed in the articular cartilage of joints of animals kept for a long time in the stable on account of serious lameness. It is seen in the beginning of arthritis deformans, etc.

Describe fungous arthritis.

It is of little practical moment in animals. In birds, where it is more frequently met with, it attacks the joints of foot and wing; in swine, the hock and knee; in cattle, knee, stifle and hip joints. It consists of an inflammation of the synovial membrane with fungous-like deposits upon it, as well as necrosis and rarefaction of the bones and cartilage.

What is articular rheumatism?

A serous polyarthritis due to a general infection.

What joints are usually affected?

The stifle, hock and carpus.

What complication is dangerous and common to it?

Endocarditis.

Is it a chronic or acute disease?

While setting in acutely, its course is a chronic one.

Describe the changes in the joints.

As a rule, a number of articulations are attacked at the same time (polyarthritis). At first there is a serous synovitis leading in some cases by its chronicity to an arthritis deformans. In the acute cases the synovial membrane is reddish and swollen. The articular cartilage is also reddish, becomes later yellowish and has a velvety appearance. The epiphyseal ends of the bones appear reddened and even hemorrhagic, the marrow showing a similar state. The tissues surrounding the joint are hyperemic and cedematous. In advanced stages the synovial membrane is very much thickened, the cavity of the joint may show the changes of a pannaceous arthritis, the articular cartilage undergoes fatty degeneration and ulceration. A true arthritis deformans is occasionally observed. Of other symptoms, those of endocarditis, pleurisy and peritonitis complicate the case.

What animals are most subject to articular rheumatism?

Especially cattle; more rarely horses, dogs, swine.

How do you treat articular rheumatism?

Main reliance is placed upon large doses of sodium salicylate.

What is pyemic and septic arthritis of the young?

A purulent polyarthritis of metastatic origin, the result of an infection of the umbilical wound of the newly born.

Outline the diseased process.

Infection of the navel leads to the formation of a purulent thrombus in the bloodvessels of that region; in other words, there is a purulent thrombophlebitis and thromboarthritis. Little bits of this purulent thrombus break off (embolus) which, carried away by the circulation, produce a general

systemic infection which may be a pyemia or septicemia. Soon after, a febrile reaction is shown by the animal, the joints, especially the hock, stifle, hip, knee, elbow, shoulder joints swell, terminating by abscess formation in them. Such animals live from two to three weeks, when they die with symptoms of either pyemia or septicemia.

Describe the most important changes in septic or pyemic arthritis.

The synovial membrane is red and swollen. The synovia is increased in quantity and turbid or even replaced by pus. The articular cartilage and even at times the bones are necrotic. The tissues surrounding the joints exhibit abscesses. The other post mortem changes are those peculiar to pyemia or septicemia.

How do you treat septic arthritis ?

The treatment of the affected animal is practically hopeless ; the main feature is prophylaxis, as disinfection of the umbilicus and stable.

Describe gouty arthritis (arthritis urica).

Peculiar to birds, occasionally seen in the dog ; supposed to be the result of an excess of uric acid in the blood and tissues, impaired metabolism, etc. It is characterized by deposits of sodium biurate in and around joints.

What is periartthritis ?

It is an inflammation of the soft tissues surrounding a joint.

Name the soft tissues involved in the inflammatory process.

The peritoneum, synovial sheath of tendons and synovial bursæ.

Give a common example of periarthrititis.

Periarticular ringbone, taking its origin from the point of insertion of the lateral ligaments of the first interphalangeal articulation.

Explain the nature of a periarticular ringbone.

This form of ringbone is the result of a primary chronic ossifying periostitis produced by a tugging upon the lateral ligaments of the joint, such as follows faulty positions of the limb, for instance, in contrast to true articular ringbone, which starts either as a primary osteitis or occasionally as an arthritis deformans, showing that there is a marked difference between articular and periarticular ringbone.

Luxation of a Joint.

What is luxation ?

A permanent separation of two articular surfaces from each other with partial or complete laceration of its ligaments.

What is a subluxation ?

A partial or incomplete dislocation ; that is, the articular ends are more or less in contact with each other, the ligaments being rarely torn.

What is a simple, what a complicated luxation ?

In the former there is no serious damage done to the surrounding soft parts or the bones, the articular ends are not exposed to the air ; while in the latter there is serious injury of soft parts or bones, as, for instance, a fracture, the articular ends being in contact with the external air.

What is a recent, what an old luxation ?

The terms recent and old in this instance are not suggestive of the time passed since the accident, but indicate the

changes in the parts involved. Therefore, in the former the displaced bone is not yet fastened by tissue changes in the place into which it was forced, while in an old dislocation the displaced bone is held firmly in its new location by tissue changes.

What is relapsing or habitual luxation ?

It is a dislocation recurring frequently and from slight cause.

Depending on the cause, what forms of dislocations are recognized ?

1. Traumatic dislocations : Due to sudden force.
2. Pathological or spontaneous luxations : Due to inflammatory and other pathological processes.
3. Congenital dislocations : Due to a congenital malformation of the joint.

How does sudden force produce traumatic luxations ?

The joint is either dislocated directly by a blow of some sort, the latter driving the articular ends apart, or external violence may act indirectly in this way : A bone struck at a distant part transmits the force of this blow to its end, which drives it (the bone) out of the joint. Finally, sudden and severe muscular contraction may be an active cause of luxation by pushing the head of the bone powerfully against the weakest part of the ligaments retaining the articular ends.

Give some examples of traumatic dislocations.

In the horse, the more common ones, although not as frequent as fractures, are upward dislocation of the patella by sudden powerful contraction of the triceps femoris, as seen in kickers ; luxation of the cervical vertebræ (not a rare sight when a lot of bronchos undergo training) ; dislocation of the

metacarpo-phalangeal articulation, occasionally seen in runners.

In the ox ; sacro-iliac articulation in cows dislocated during severe labor or by empiric assistance, and hip joint.

In the dog, hip, elbow, cervical vertebræ, inferior maxilla.

Name some pathological processes which produce spontaneous luxation ?

In these dislocations one deals with a joint relaxed by previous disease and thus predisposed to luxations. Such may be a deforming arthritis or a chronic serous arthritis and edema of the retaining ligaments, as a result of which they easily yield to pressure, thus favoring dislocations.

Describe congenital dislocations.

In these cases the animal is born with a malformation of a joint, as a result of which the bone cannot retain its normal position. Those dislocations met with in the newly born and occurring during delivery as the result of rough handling do not belong here, but must be classified among traumatic dislocations. The elbow joint of the dog is subject to congenital luxation.

What are the symptoms offered by a dislocation ?

Generally speaking, they are : Simple dislocation, abnormal rigidity in one direction and excessive mobility in another direction. In joints not covered with a heavy layer of muscles there is a visible change in the shape of the articulation. In case the luxation affects an articulation of the leg, the normal position of the bony columns is disturbed, the part may be abnormally extended or flexed, abducted or adducted. The leg appears longer in incomplete luxations, while it appears shorter than normal in complete luxations. In luxations of joints of the leg there is severe lameness and pain.

In complicated luxations the symptoms peculiar to severe injury of the surrounding soft parts, as well as fracture of the dislocated bone, will be observed, such as external wounds, rupture of tendons, laceration of bloodvessels large and small, injury to more or less important nerves, open joint, etc.

Describe the articular changes following a luxation.

There is invariably a rupture of the capsular ligament ; the surrounding tissues—that is, the ligaments, nerves, bloodvessels, tendons and muscles—are either stretched or torn. An exception to this rule forms the dislocation of the patella, sacro iliac articulation and the symphysis pubis. In the so-called spontaneous or pathological dislocations, as seen in dislocation of the patella, chronic arthritic changes are frequently observed. As soon as luxation of a joint occurs and the capsular ligament is torn a hemorrhage into and surrounding the joint, possibly including the adjacent connective tissue, muscles, etc., takes place. The old socket is filled with blood and the dislocated bone is imbedded in a bloody area. If an uncomplicated dislocation is reduced early, an almost normal condition is obtained in due time, unless some of the lesions undergo a faulty repair leading to subperiosteal formation of bone or periarticular thickening. In old luxations the process of repair is quite different. Let us suppose that the head of the femur has left the cotyloid cavity. I have seen and described in the current literature two such cases in mules observed in South Carolina. In horses it is very rare, but more common in dogs. The head of the femur in its new position is in contact with a bony surface, against which it presses. As a result of this pressure an osteitis and periostitis results which in turn leads to formation of bone around the head of the femur, and a new bony socket, even lined with

cartilage and endowed with a capsular ligament, may be formed. The lacerated and displaced connective tissue around the head of the femur, as well as the injured muscles, form adhesions holding the dislocated bone firmly in place.

Outline the treatment of dislocations.

Provided such is possible, reduction and retention of the dislocated parts are primary essentials. In luxation not accompanied with serious lesions of the constituents of the joint or surrounding tissues, the rent in the capsular ligament soon heals, while the hemorrhage into the joint and surrounding tissues is absorbed. In the larger animals, such as the horse or cow, reduction is very difficult and retention often impossible; in the smaller animals—as the dog, for instance—the dislocation can be reduced more readily, but the restlessness of the patient renders retention of the reduced articular ends very difficult or impossible. In old luxations of the hip of the dog no attempts at reduction are made; it is best to await the formation of a new socket by nature's efforts at repair. Dislocation of the inferior maxilla of the dog and luxation of the patella of the horse are easily reduced. For a cure of habitual luxation of the patella, section of the internal patellar ligament has been advocated more recently. I have operated on three horses, but the time which has elapsed since the operation is too limited to permit of conscientious criticism.

Distortion (Sprain).

What is a distortion?

A temporary displacement of two articular surfaces from each other, followed by an immediate return to place and by a partial or complete laceration of the retaining ligaments.

Where does the main point of difference lie in a dislocation and distortion ?

In the dislocation the separation of the articular ends is permanent and requires artificial aid for its reduction ; in distortion the separation is momentary and the displaced articular ends snap back into place by their own account.

Depending on the severity of the sprain, what two forms are recognized ?

1. Simple : No serious damage to the joint or adjacent tissues.

2. Complicated : More or less serious injury to the ligaments, synovial membrane, bone, cartilage and soft tissues surrounding the injured articulation.

What are the causes of distortions ?

Anything causing a sudden wrench or twist of a joint, as slipping, getting caught in street rails, stumbling, faulty positions of limbs, faulty shoeing.

How do faulty positions of limbs produce distortions ?

It is a well-known clinical fact that horses which toe out or toe in often furnish clinical material for these cases. These animals have often an awkward gait—that is, they stumble quite readily—as a result of which sprains follow ; furthermore, the retaining ligaments of their phalangeal articulations especially are in a somewhat relaxed state, the articular surface of their joints, by reason of the peculiar position which the bony column exhibits, is irregularly weighted ; that is, one side of the joint bears more of the body weight than its partner, leading to a straining of the ligaments of the other side of such a joint.

How does improper paring of the hoof or shoeing produce distortion ?

In a way similar to the one just explained. A hoof, one-quarter of which is left higher than its mate, will, at the moment it is placed upon the ground to receive the weight of the body, wobble more or less; in other words, the phalangeal articulations are at that moment twisted, which, as easily seen, leads to distortions.

What articular changes take place in simple and complicated distortions ?

In simple sprains the capsular ligament is usually crushed, but may be torn; the ligaments, not being elastic, cannot stretch, but elongate a little; as soon as their limit is reached a few of the fibres rupture or the whole ligament tears.

In simple dislocation there is bleeding within and without of the articulation. In complicated distortions, the capsular membrane is likely to be torn, the ligaments lacerated more or less, the entire ligament may be detached from the bone, there may be a fracture or dislocation, extensive hemorrhage into the joint cavity and surrounding tissues.

What symptoms does a distortion produce ?

Sudden lameness; quite often after a few steps this first or primary pain disappears, to reach a high degree as soon as the animal obtains some rest and is then started. This so-called secondary pain is the result of the setting in of an inflammatory reparative process. Now heat, swelling, at first doughy, later firm, pain on palpation, especially on rotation of the joint, are evident.

How do distortions terminate ?

In those cases where the capsular ligament and the other retaining ligaments are not torn, recovery takes place in a few

days, but when the retaining ligamentous apparatus is lacerated a periarthrititis develops in a few hours. These cases require four to six weeks for recovery. Whenever the ligament is actually torn the synovial membrane is seriously injured and possibly the bone, when there is a considerable hemorrhage into the joint cavity, the chances for a complete recovery are very slim, as a marked periarthrititis may lead to the formation of a periarticular ringbone, or the seriously injured synovial membrane and joint become chronically diseased, exhibiting a chronic serous arthrititis; even an arthritis deformans may be the result. Septic complications are not excluded, as the skin may have been injured at the time the animal fell or stumbled. The above shows that in all distortions accompanied with severe and persistent lameness the prognosis must be a guarded one.

Outline the treatment of distortions.

The first point is rest. When the season and conditions of the barn permit it, cold water applications with firm bandaging of the sprained joint is indicated the first day. From the second day on, moist heat and compression of the joint follow. Where this line of treatment is impossible, a blister is applied or combined with the actual cautery. In some instances, where all these means fail, neurectomy may be practiced.

Contusion of a Joint.

What do you understand by a contusion of a joint?

It is a bruising, a subcutaneous injury of the tissues surrounding and composing a joint.

What are the causes of such contusions?

Blows, pressure, etc., either act directly upon a joint or a

distant part is struck and the force of the blow transmitted to the epiphyseal ends of the bones. The latter represents an indirect contusion.

What articular changes take place in contusions of joints ?

In direct contusion the capsular ligament and periarticular tissues are mainly injured, while in the indirect contusion the articulating bony ends, by striking against each other, compress and injure their hyaline cartilage, and even the bones themselves may fracture as the result of the blow.

What are the symptoms of articular contusion ?

As a rule, the hemorrhage into the joint cavity in contusion is considerable; as a result of which a fluctuating swelling about the joint appears; otherwise the symptoms are those of a distortion only; the phenomena are all of a milder type.

How do articular contusions terminate ?

As a rule, favorably. Occasionally a chronic serous arthritis—that is, a gall—remains behind. Of course contusions complicated with fractures demand an unfavorable prognosis, at least in the larger animals.

Outline the treatment of contused articulations.

In the earliest stages cold and pressure to prevent further hemorrhage into the joint and surrounding tissues; later, moist heat and compression; generally speaking, a blister is the most reliable and least troublesome treatment. /

Anchylosis.

What is articular ankylosis ?

Destroyed joint mobility.

What kind of tissues are found to be the cause of ankylosis of joints ?

Joints are rendered immovable by fibrous, cartilaginous and bony adhesions.

What is an intracapsular, what an extracapsular ankylosis?

In the former, also known as intra-articular ankylosis, the consolidating mass lies within the joint cavity, while in the latter it lies external to the capsular membrane.

Give the etiology of articular ankylosis.

In navicular hoof disease, in spavin and articular ring-bone, it is the result of a deforming arthritis. Ankylosis of the vertebral column, as in old horses, is due to ossification of the intervertebral fibrocartilages. It may be due to an ossifying periostitis such as arises in the course of a periarthrititis. Generally speaking, it is the result of a chronic arthritis.

When does the surgeon encourage the formation of an ankylosis ?

As soon as a joint is ankylosed it becomes stiff, and not being able to move any more, it also becomes painless. This painless state is what the surgeon desires to obtain, as the absence of pain means equally well—in a great many cases at least—an absence of lameness. For this reason, for instance, a horse spavin-lame is fired and blistered with the hope to ankylose the parts and thus remove pain and lameness.

How do you treat ankylosis ?

In animals, at least, it is incurable. Such operations as osteotomy, resection of joints and arthrotomy, while invaluable to man, are of little practical interest to the veterinary surgeon.

Articular Contracture.

What do you understand by articular contracture?

An incomplete ankylosis—that is, a permanent impairment of joint mobility—accompanied by fixation of the joint at an abnormal angle.

What are the causes of articular contractures?

They may be acquired and the result of diseases of tendons, muscles, nerves, skin or joints, or they are congenital, in which case the creature is either born with them or predisposed to them.

Name the various forms of joint contractures.

(1) Arthrogenous contractures, (2) tendogenous, (3) myogenous, (4) neurogenous, (5) cicatricial, (6) congenital.

What are arthrogenous contractures?

In these, pathologic lesions in or close to the joint hinder free mobility.

Give examples of arthrogenous contracture.

In the earlier stages of arthritis deformans, as in articular ringbone, exostoses about the joint, loose bodies in the joint.

Which is the most common example of arthrogenous contracture in the horse?

That due to articular arthritis.

What is a tendogenous contracture?

In this form the mobility of a joint is limited by adhesions and shortening of flexor tendons.

Give an example of tendogenous contracture.

The one most commonly seen is met with in the foreleg of the horse, where the mobility of the phalangeal articulations

becomes limited as the result of chronic inflammation of the flexor pedis perforans and perforatus, the latter being followed by adhesions and shortening of these tendons.

What is a myogenous contracture ?

In these, free mobility of the joint is interfered with by a shortening of muscles.

Give an example of myogenous contracture.

In the crooked tail as the result of contracture of the lateral coccygeal muscles, in the so-called wry neck (*caput obstipum*), there exists a contracture of the mastoido humeralis. In the so-called sprung knee, where a contracture of the external and oblique flexor of the metacarpus is found.

What are neurogenous contractures ?

In these the free mobility of the joint is limited, as the result of faulty enervation of certain muscles.

Give an example of neurogenous contracture.

This condition is quite often seen in the newly born animal, especially colts, most likely due to a paralytic state of the extensor muscles of the legs, as the result of which the animal knuckles over.

What is a cicatricial contracture ?

In this form the mobility of the joint is handicapped by the formation of a large amount of scar tissue in close proximity to a joint, especially when involving the flexor surface of a joint ; such cicatrices may be due to burns, wounds, and are quite common in our country, especially where barbed wire fences are used, the flexor surface of the hock and fetlock being common sites of such cicatricial contractures.

What is congenital contracture ?

The only one of practical interest is the neurogenous contracture seen in the newly born colt, where, as the result of a paralytic state of the extensor muscles of the legs, the young creature knuckles over in the fetlock more or less.

Outline the treatment of contractures.

In arthrogenous and cicatricial contractures, at least always in the former, the case is hopeless. In tendogenous contracture tenotomy is to be tried and is sometimes successful. In myogenous contractures myotomy is indicated, giving in the sprung knee fair results, and usually good, while not permanent, results in crooked tails; the congenital neurogenous contractures are treated by mechanical appliances, such as splints, bandages, etc.

What is the difference between a contracture and a contraction ?

From a medical point of view the former represents a permanent rigidity of a part, while the latter represents a temporary rigidity. For instance, in lacerations of the external and oblique flexors of the metacarpus, scar tissue forms, leading to a shortening (more or less), and therefore permanent rigidity of these muscles in this instance is a contracture, while a temporary contraction of these or other muscles, for that matter, as the result of a clonic spasm, would lead to a temporary rigidity of the muscle; in other words, to a contraction.

Loose Bodies in the Joint (Corpora Libra).*What are corpora libra ?*

These are smooth, white bodies of variable size, appearing single or multiple, in a joint cavity or synovial tendon sheath,

either floating free or attached by a pedicle to the synovial membrane.

What are the corpora libra composed of ?

Fibrous tissue, bony or cartilaginous, or a mixture of these.

How large are they ?

They vary in size from millet seed to pigeon egg size.

How are corpora libra developed ?

1. Usually due to a traumatism, as a piece of cartilage of bone may have been loosened by a complicated distortion, contusion of a joint, etc.

2. From villous outgrowths of the synovial membrane.

3. From blood clots and fibrin poured out during an acute inflammation.

4. From detached pieces of cartilage, as in arthritis deformans.

5. From extra capsular neoformations which have invaded the joint cavity.

Are corpora libra often seen in animals ?

They are rare, and only occasionally seen in the knee, hock and stifle joints.

What symptoms do they give rise to ?

By wedging the joint a sudden lameness of intermittent character which cannot be accounted for suggests loose bodies in the joint. Careful palpation may or may not detect them.

How do you treat loose bodies in the joint ?

The difficulties connected with executing an aseptic operation in the horse and applying the proper dressing to

keep the wound aseptic (a vital factor in a joint) would suggest the desirability not to operate the horse, while the dog offers better chances for a successful arthrotomy.

DISEASES OF TENDONS.

Inflammation of Tendons (Tendinitis).

What is tendinitis?

An inflammation of a tendon.

Name the causes of tendinitis.

Predisposed to this trouble are animals with a sloping fetlock, those with poorly developed—that is, weak—tendons, animals with low heels or long toes, the latter frequently seen in our trotting horses, where the toes are allowed to remain excessively long by some trainers; nutritive disturbances, such as follow prolonged idleness in the stable; infectious diseases. Direct causes, usually of a traumatic nature, of primary tendinitis are prolonged hard work, jumping, galloping, hard pulling, as in runners, trotters and draught horses; contusions, the result of kicks, etc., are occasionally the cause.

Secondary tendinitis—that is, a tendinitis the result of an extension of an inflammatory process to the tendon from neighboring parts—are seen in cellulitis of the synovial sheath in consequence of aseptic cellulitis of the plantar cushion and in those inflammations of tendon sheaths, sequels to contagious pleuro-pneumonia, etc.

In Italian and Russian horses, the presence of the *filaria cincinnata* and *spiroptera reticulata* is given as a cause of tendinitis.

What anatomical lesions are found in tendinitis ?

More or less laceration of tendon fibres, accompanied by a sero-hemorrhagic exudate infiltrating the interfascicular connective tissue, is the first step. Now the inflammation extends to the peritendineum and paratendineum, causing a swelling of tendon as the exudate pushes apart the bundles of tendon fibres. The sero-hemorrhagic exudate first alluded to is replaced by an invasion of the parts by leucocytes; new blood-vessels and connective tissue are formed. The granulation tissue which is formed springs mainly from the paratendineum, the tendon sheath and a limited amount of it comes from the tendon cells of the ruptured tendon fibres. This soft granulation tissue gradually undergoes changes until eventually it becomes hard cicatricial tissue, which may not only be simply connective tissue, but in its transformation becomes cartilaginous or even bony.

Three years ago, while studying double tibio peroneal neurectomy, I bought two horses with spavins. These animals also suffered with chronic tendinitis. Microscopical examinations made of the diseased tendons showed patches of osseous tissue in the cheek ligament of the perforans, especially abundant where the ligament blends with the flexor pedis perforans.

What danger is connected with the formation of scar tissue in tendinitis ?

It may lead to a tendogenous contracture and render the animal a cripple.

How is this brought about ?

All scar tissue has a tendency to retract. Consequently the scar tissue the result of a tendinitis shortens the tendon, thus altering materially the angularity of the various joints

controlled by that tendon. In serious inflammations, not only scar tissue forms between the ruptured fibres of the tendon, but adhesions with neighboring parts, as other tendons and tendon sheaths, occur.

How do you explain the fact that in some cases of tendinitis the tendon does not shorten, while it does in others ?

Retraction of the scar tissue can only take place when one end of the tendon is relaxed, so the scar tissue may take up the slack, so to speak.

Give an example to this effect.

Suppose that some part of the perforans tendon is affected and scar tissue forming. As a result of this, the animal has pain and does not care to support much weight upon the lame leg, as by doing so the tendon is rendered tense, which in turn causes pain. To avoid pain the animal eases the tension upon the perforans by more or less volar flexion of the palangeal articulations—that is, knuckles over—resting the hoof upon the toe. At this moment the perforans tendon is slack and the retracting scar tissue can therefore shorten the tendon, which is impossible when full weight is borne by the hoof, as under those circumstances there is no give to the tendon and consequently the scar tissue cannot retract.

What practical deduction can be made from this ?

Get your patient to support weight as soon as possible with the affected foot, to counteract the action of forming scar tissue.

What are the terminations of tendinitis ?

1. Complete recovery, only possible in very slight cases.
2. Partial recovery; in these instances the tendon remains permanently thick; depending on the severity of the lesion,

the animal either works pretty well, or there is chronic lameness, with, in the worst type, tendinous contracture.

What does the prognosis of these cases depend on ?

In running horses, unless they can be kept from hard and prolonged work, the prognosis is unfavorable, but they usually do well as drivers and saddle horses. In carriage horses and heavy draughts, the prognosis is more favorable. The facts to be considered are: how important a tendon is involved; how serious are the lesions; what amount of swelling is present; does the animal support weight; is more than one leg involved. The latter point is very important, as in these cases the creature is obliged to support weight with the diseased structures, and under such circumstances the healthy tendon fibres may give way and the animal becomes what is vulgarly termed "broken down," followed by changes in the angularity of the articulations, the limiting apparatus of which the diseased tendon was.

What are the symptoms of tendinitis ?

Pain and swelling of the tendon are the most important ones. In the earlier stages there is also increased heat of the parts, finally a change in the angularity of the phalangeal articulations. This is seen in the earliest stages by changing the position of the normal angle of the joint; the animal transfers the weight of the body to the bony column, thereby relieving the tendon. In old cases the change in the position of the articular angle is due to the retraction by the scar tissue.

What kind of swelling is seen in the various stages of tendinitis ?

Palpation reveals a diffuse, almost soft, swelling in the beginning, due to the fact that the bundles of tendon fibres

are separated by a liquid exudate; later, as granulation tissue develops, the swelling becomes firm, until finally it is hard.

How do you palpate a tendon ?

Always examine a tendon for thickening and for painful states by raising that part of the leg off the ground, as it is impossible to make a thorough examination—or one beyond criticism—by allowing the animal to stand upon the affected leg (see my work on “Clinical Diagnosis of Lameness in the Horse,” page 19).

What tendons are usually affected by tendinitis ?

The flexor tendons of the foreleg, more rarely those of the hindleg, as the flexor pedis perforans or more commonly its strong stay coming from the great posterior ligament of the carpus; the suspensory ligament (superior sesamoidal ligament) and the flexor pedis perforatus.

Outline the treatment of tendinitis.

Rest is essential, with a run to grass if possible after the lameness has disappeared. Shorten long toes, raise low heels and remove toe calk. The first two days, continuous cold; later, moist warm applications, with a pressure bandage (take two rolls of oakum, place them upon either side of the tendon and apply the bandage). Change the dressing every four hours; by doing so a change of temperature takes place in the affected parts, beneficially influencing the process of absorption. Unless the case is clearly making a recovery under this treatment, apply a blister, which, together with the line firing, is at once applied to all chronic cases. In chronic tendinitis with tendinous contracture, where the animal knuckles over so completely in the fetlock that the flexor tendons are no longer rendered tense, tenotomy may give relief. Purulent states are treated by incision to give drain-

age, with irrigations of antiseptic solutions. Under certain conditions, resection of the tendon, as in nail pricks, with subsequent necrosis of the perforans tendon, is indicated, saving many a horse from certain death, provided it is executed sufficiently early.

Which is the most satisfactory method to blister a horse's tendons for chronic tendinitis ?

Clip the hair along the tendon, rub in thoroughly with good pressure for at least five minutes a red iodide of mercury blister in the proportion of 1 : 5, apply over this a layer of absorbent cotton and over this rather loosely a derby bandage. Tie up the horse for 48 hours and leave the cotton dressing undisturbed for 14 days. This method originated in Austria and has given me such excellent results that I but rarely have to line fire a horse with chronically thickened tendons. It is vastly superior to the old method of simply rubbing in the blister, tying up the horse for 48 hours, washing it off and applying lard to the blistered parts, etc.

What parts of the flexor pedis perforans are subject to tendinitis ?

In the heavy draught horse almost invariably the fibrous stay coming from the great posterior ligament of the carpus is involved ; more rarely is the analogous subtarsal ligament of the hindleg diseased. In this instance the perforans tendon itself is but little or not at all involved. On the hindleg, tendinitis of the perforans either at the tarsal sheath—that is, right at the hock—or at the sheath just below the sesamoids, this tendon is subject to inflammatory changes.

In what animal is tendinitis of the flexor pedis perforatus usually seen ?

Practically only in the saddle horse, simply because this

tendon is taxed as it receives the full shock by the weight of the body as the animal jumps or gallops.

In what animal is tendinitis of the superior sesamoidal ligament usually seen ?

More commonly in the saddle horse and trotter, for the same reasons that the perforatus becomes diseased. In those cases where this ligament gives way either partially or ruptures entirely, the fetlock descends more or less, a condition termed by the sporting fraternity as "broken down tendons."

Rupture of Tendons.

What forms of tendon rupture are of interest ?

Incomplete and complete rupture.

What are incomplete tendon ruptures ?

In these one or more tendon fibres, or possibly a little bundle of tendon fibres, may give way, these ruptures being microscopical in nature, and have just been fully dealt with under "Tendinitis."

What are the causes of complete tendon rupture ?

They are the same as those of tendinitis, only in an exaggerated form. Thus, excessive stretching is the most common traumatic cause. At the same time certain conditions predispose the animal to these ruptures, as contagious pleuro-pneumonia, purpura hemorrhagica, or purulent tendovaginitis, and the not uncommon chronic inflammation of the navicular bursa.

Which are the more common tendon ruptures in animals ?

Horse : Flexor pedis perforans and perforatus, superior sesamoidal ligament and the flexor metatarsi.

Cattle : Tendo Achilles and flexor metatarsi.

Dog : Tendo Achilles and flexor metatarsi.

What are the symptoms of tendon ruptures ?

They vary according to the tendon involved. The first thing is sudden lameness with more or less dorsal flexion of the phalangeal joints. In case the superior sesamoidal ligament is torn, the hoof bears weight with its whole plantar circumference, but the fetlock is let down—that is, exhibits excessive dorsal flexion. In case of the perforans, there is some dorsal flexion of the phalanges and the toe of the hoof is turned up a little, while in rupture of the perforans all three phalangeal articulations show decided dorsal flexion, weight being borne only by the heel of the hoof with the toe of the hoof distinctly elevated from the ground. In the earliest stages the point of division of the tendon can usually be felt, but is soon obscured by inflammatory swelling.

What is the prognosis of these tendon ruptures ?

Those of the forelegs, unless due to necrosis, which are usually incurable, heal in two to three months.

What are the symptoms of rupture of the flexor metatarsi ?

Sudden swinging-leg lameness ; the angle of the hock joint is wide open—that is, the tarsal articulation is extended to its fullest extent—while the stifle joint is decidedly flexed. The thigh totters so much that the two hocks may strike against each other. When the hand grasps the fetlock and brings the leg backward, no resistance is felt, as the flexor metatarsi is out of action at this moment ; the tendon achilles is strongly relaxed.

What is the prognosis of rupture of the flexor metatarsi ?

As a rule, recovery sets in in one to two months, leaving quite often a snappy gait.

What are the symptoms of rupture of the tendo achilles ?

Severe sudden supporting-leg lameness. The animal is unable to support weight, and all joints are excessively flexed. As long as no inflammatory swelling has set in, the flabby state of the tendon, as well as a gap in the tendon, can be detected. Passive movement of the hock permits of exaggerated flexion of the joint.

What is the prognosis of rupture of the tendo achilles ?

In the horse and ox it is unfavorable, especially when a portion of the os calcis has been torn off, while in the dog a more favorable prognosis is permissible.

How do you treat tendon ruptures ?

Rest is essential in rupture of the superior sesamoidal ligament, flexor pedis perforans and perforatus ; a plaster paris dressing—or, probably just as good, a blister—is indicated. In rupture of the flexor metatarsi rest is all that is necessary. In rupture of the tendo achilles in the dog the tendon may be sutured or a plaster paris bandage applied. When the larger animals are to be treated for this rupture they must be placed in slings.

What do you understand by luxation of the flexor pedis perforatus ?

A permanent separation of the fibrous cap of this tendon from the posterior portion of the point of the os calcis.

Give the etiology of dislocation of the flexor pedis perforatus.

Over-exertion and external violence.

What are the symptoms of this luxation ?

Entirely out of proportion is the slight lameness and the unsteady, tottering gait. Each time the hock is extended the

cap of the perforans will be seen to slip off the point of the os calcis, as a rule returning to its place as the leg is flexed. Swelling is usually pronounced, as this injury more frequently follows external traumatisms.

What is the prognosis of this dislocation ?

Almost invariably unfavorable, as it is almost impossible to retain the dislocated tendon.

Tendon Necrosis.

What are the causes of tendon necrosis ?

It is the direct result of a purulent tendinitis.

Is purulent tendinitis of primary origin in these cases ?

Not usually, but is the result of purulent cellulitis of some neighboring organ from which the septic process spreads to the tendon.

Why do tendons easily undergo necrosis ?

Because their powers of regeneration and blood supply are limited.

Which tendon is most frequently exposed to necrosis ?

The plantar aponeurosis of the flexor pedis perforans of the horse.

Where does the infection of the plantar aponeurosis start from ?

* Almost invariably there is at first, as the result of a nail-prick, a purulent cellulitis of the plantar cushion. From here the septic process extends to the navicular bursa and now the termination of the perforans becomes easily involved, as it is, so to speak, bathed in pus, there being a purulent bursitis; the continuous action of the pus producing necrosis of the tendon.

Generally speaking, what are the symptoms of necrosis of the plantar aponeurosis ?

Intense supporting-leg lameness, marked volar flexion of the phalanges, severe swelling in the hollow of the heel and of the frog.

What does the necrotic tendon look like ?

The necrotic parts have a greenish yellow, sluggish appearance.

What is the prognosis of necrosis of the plantar aponeurosis ?

It is good, provided the animal is operated in time. Some operators give the time required for recovery from one to two months ; my experience as regards time is not as favorable, most of my cases necessitating from two to three months.

Outline the treatment of tendon necrosis.

It is strictly surgical, consisting in the total removal of frog and plantar cushion until the perforans tendon can be removed from the semi-lunar crest of the os pedis to the superior border of the navicular bone. Necrotic portions of the bursa and bone are removed, a drain made from the hollow of the heel to the field of operation, the wound given an iodoform tampon dressing, the hoof bandaged, etc.

DISEASES OF SYNOVIAL SHEATHS OF TENDONS.

Inflammation of a Synovial Tendon Sheath (Tendovaginitis).

Why are inflammatory processes of synovial tendon sheaths and those of joints closely related ?

Because in either instance a synovial membrane is involved. It may be classified as a serous membrane, its inner layer being lined with endothelial cells, being analogous to the pleura and peritoneum.

What forms of tendovaginitis are recognized ?

According to its course it is acute or chronic, depending on the origin, primary or secondary, in regard to the cause, aseptic or traumatic, infectious or septic, according to the exudate, serous, fibrinous, purulent.

From a practical point of view, which forms are the most important ones ?

The acute and chronic, serous and fibrinous, and the acute purulent form.

What is serous tendovaginitis ?

Inflammation of the synovial sheath of a tendon with a serous exudate into the sheath.

What are the causes of serous tendovaginitis ?

Usually mechanical irritations, as overwork (more rarely contusions), or infectious diseases, as contagious pleuropneumonia, septicemia, etc.; in the latter usually more than one tendon sheath is diseased, while in the former, as a rule, one synovial tendon sheath only exhibits pathological lesions.

What are the symptoms of an acute tendovaginitis ?

Pain on palpation and expressed by lameness, with increased heat, more or less fluctuation and swelling along the sheath.

What course does serous tendovaginitis take ?

The parts either make a recovery by absorption of the serous exudate, or when resorption is tardy a condition commonly termed a gall, or, scientifically speaking, a chronic tendovaginital dropsy, or in very aggravated cases, thickening of the synovial sheath (chronic fibrous tendovaginitis), producing more or less enlargement, sets in.

What tendon sheath is preferably involved in chronic fibrous tendovaginitis ?

The sheath common to the flexor pedis perforans and perforatus, but right above the fetlock of the hind-legs, although in these cases the tendons themselves are also diseased.

What is the prognosis of serous tendovaginitis ?

Those due to simple traumatism are quite favorable, while those due to infectious diseases are less so ; again, those of the flexor tendons are less favorable than those of the extensor tendons.

Why is the prognosis of tendovaginitis of the flexor tendons less favorable than those of the extensor tendons ?

Because the sheaths of the extensor tendons are less extensive and when diseased they do not interfere as much with the functions of the leg, as it would be in case the flexor tendon sheath is diseased.

Outline the treatment of acute serous tendovaginitis.

Absolute rest, Priesnitz fomentations ; while the quickest way out of it is a blister.

What is purulent tendovaginitis ?

An inflammation of a synovial tendon sheath with a purulent exudate into the sheath.

What are the causes of purulent tendovaginitis ?

1. Pus-producing bacteria are carried directly into the sheath from without (nail pricks, pitchfork jabs, etc.).

2. The result of a contiguous septic inflammation ; for instance, in septic cellulitis of the plantar cushion, spreading into the navicular sheath.

3. Of hematogenous origin, as in pyemia.

What are the symptoms of a purulent tendovaginitis ?

Severe lameness, high fever. The swelling rapidly spreads beyond the limits of the tendon sheath, and when of sufficient virulence the lymph vessels also swell ; when due to a perforating wound, there is discharge of a straw colored, lumpy synovia ; later, abscesses form in the phlegmonous swellings ; finally, the symptoms of septicemia or pyemia prevail.

Outline the treatment of purulent tendovaginitis.

As soon as there is reason to presume that pus is present in the sheath or the tendon necrotic, the knife claims its rights. Incisions, drainage and antiseptic irrigations and removal of the necrotic parts are indicated.

Galls (Chronic Dropsy of Tendon Sheaths).

What do you understand by chronic dropsy of tendon sheaths ?

A painless, non-inflammatory state of synovial tendon sheaths, thickened by connective tissue proliferation and distention of the same by an accumulation of serous fluid.

DISEASES OF SYNOVIAL SHEATHS OF TENDONS

What are the causes of chronic dropsy of tendon sheaths ?

Wind galls—as this condition is vulgarly termed—are the result of repeated mechanical irritations of the tendon sheath by the friction upon its walls from the gliding of the tendon; in other words, it is the sequel of a repeatedly occurring acute serous tendovaginitis.

In what animals is it common ?

In all those doing continuously hard work ; therefore occurs usually in the adult, being more frequently seen in the hindlegs than in the forelegs.

Which are the most important galls of the sheaths of the flexor tendon ?

Foreleg : The perforans and perforatus, as they pass through the carpal sheath, are enveloped by a synovial sheath, which, when distended, appears as a longish swelling, as far as four inches above the carpus, and runs down to the upper third of the metacarpal bones.

Chronic distention of the metacarpo-phalangeal sheath, which also forms an envelope common to the perforans and perforatus at the fetlock, represents the so-called wind galls. It forms a longish swelling, which, above the fetlock, is divided into two swellings by the tendon extending to the lower third of the metacarpal bones. Below the fetlock the swelling appears flattened and is by no means as often seen as the upper swelling.

Hindleg : The flexor pedis perforans is enveloped by a large synovial sheath occupying the internal and posterior surface of the tarsal articulation ; that portion on the internal face of the joint, when distended, appears as a globular enlargement of variable size.

The perforatus has a synovial sheath beginning at the point where the perforatus tendon crosses the gastrocnemius tendon and extending as far as the os calcis. When distended it appears as a swelling of variable size on either side of the tendo achilles, just above the point of the os calcis.

At the fetlock chronic distention of the sesamoidal sheath enveloping the perforans and perforatus is common. It is much more frequent in the hind legs and more prone to exhibit fibrous thickening in the wall of the sheath, representing, pathologically speaking, a chronic fibrous tendovaginitis, or, as it is vulgarly called, a hardened wind gall.

Which are the more common galls of the sheaths of the extensor tendons ?

Forelegs : The distended sheath of the extensor suffraginis starts three to four inches above the carpus on the outside of the forearm and runs downward as far as the anterior face of the carpus.

The sheath of the extensor pedis, which is rarely seen distended, begins about six inches above the carpus, runs over its anterior face to the upper portion of the metacarpus. This tendon rests upon a mucous bursa of the metacarpus or metatarsus, occupying the anterior face just above the fetlock joint, which may attain the size of an egg.

The distended sheath of the extensor metacarpi magnus occupies the middle of the anterior face of the carpus, but does not go as far up or down as the one of the extensor pedis.

The distended sheath of the extensor metacarpi obliquus begins near the outside and about three inches above the carpus, running obliquely down and inward over the anterior face of the carpus to the head of the inner small metacarpal bone.

Hind leg : A common sight is the distended sheath of the peroneus tendon, found at the external and lower part of the hock.

What is the prognosis of chronic dropsy of the synovial tendon sheaths ?

This condition, as a rule, does not lame the animal, representing, therefore, more a blemish than anything else. Taking it all around, one can safely say that chronic dropsy of the tendon sheath is incurable. A cure here and there occurs.

Outline the treatment of dropsy of the synovial sheaths.

To the cautious, conservative surgeon these synovial sheaths, when chronically distended by a serous exudate, are a sort of *noli me tangere*—at least with the knife—this referring especially to the sheaths of the flexor tendon, simply because of the possibility of a septicemia or pyemia following the opening of such a sheath. Practical experience has shown innumerable times that the opening of the synovial sheaths, even when aseptically done, is not without danger, as it is very difficult to keep an aseptic dressing in place ; nevertheless, horses have been operated successfully by this method. Puncturing the sheath with the needle-pointed firing iron also is risky. The injection of a watery solution of iodine, while less dangerous, is by no means reliable. Finally, puncture or line firing or blisters are of questionable value, almost invariably failing.

The lameness of the so-called hard galls, the result of disease of the perforans tendon and chronic fibrous changes of the tendo-vaginal sheath, are frequently helped by line firing plus blistering. Should this fail, tibial neurectomy will give fair results.

DISEASES OF THE MUCOUS BURSA.

Bursitis.

What do you understand by bursitis?

Inflammation of a mucous bursa.

What forms of bursitis are recognized?

They are classified in the same way as diseases of the tendon sheaths or joints.

Which bursitis is of practical interest?

Of the various bursæ, that of the olecranon and os calcis, either as an acute serous or acute purulent bursitis, are of special and everyday interest to the practitioner.

What other bursæ are quite often inflamed?

The navicular bursa, as in navicular hoof disease; the trochanteric bursa, as in lameness due to inflammation of the tendon and tendon sheath of the middle gluteous muscle; also the intertubercular bursa lodged in the bicipital groove of the humerus for the benefit of the flexor brachi, which, when diseased, gives rise to marked shoulder lameness.

What are the causes of acute serous bursitis?

Usually some external traumatism, as contusions, pressure, blows.

What is the most common cause of olecranian bursitis?

Capped elbow, as this condition is commonly termed, is frequently seen in horses, which, for some reason or other, lie down a great deal (those afflicted with chronic lameness, as pododermatitis, navicular arthritis, etc.). In this instance the region of the olecranian bursa is bruised by the pressure of the shoe.

Which is the most common cause of calcanean bursitis?

This condition, also termed capped hock, is frequently seen in horses which, as a vice, bang their hocks against the stall partition. When backing a horse, and the hold back part of the harness is too long, the animal will strike the point of the os calcis frequently against the whiffletree and thus bruise the bursa.

What are the symptoms of acute bursitis?

There is a swelling of variable consistency, possibly fluctuating or rather firm, more or less edema of the parabursal tissue (tissue surrounding the bursa), but little pain on palpation.

Outline the treatment of acute bursitis.

The first thing consists in the removal of the direct cause, such as padding the stall partition for a kicker, changing the shoe, giving plenty bedding or a box stall, etc. Wherever possible, try to absorb the serous fluid and avoid the opening of the distended bursa while acutely inflamed, as a purulent bursitis, which is tedious to treat, is almost sure to follow an incision.

Purulent Bursitis.

What is purulent bursitis?

An inflammation of the bursa with pus formation.

What are the causes of purulent bursitis?

It may be the consequence of incising a serous bursitis, pus germs entering the bursa through the wound, or it may follow a contusion sufficiently severe to destroy the solution of continuity of the overlying skin with a wound extending into the bursa.

What are the symptoms of a purulent bursitis ?

There is decided swelling, septic cellulitis of the parabursal tissue, with a discharge of pus.

Outline the treatment of purulent bursitis.

Split the swelling from the center downward and introduce tampons saturated with a two to three per cent. chloride of zinc solution for two to three days ; after that employ antiseptic irrigations. I have had splendid results in the treatment of capped elbow by making a regular sieve out of the swelling by running the finest platinum point of the thermocautery through the skin deeply into the infiltrated parabursal tissue, having the holes made by the red hot point about three-quarters of an inch apart.

Chronic Dropsy of the Mucous Bursa.

What are the causes of hygroma of mucous bursa ?

When the serous or serofibrinous fluid in the bursa is not absorbed a chronic bursitis results. When now mechanical irritations, such as pressure from a shoe or kicking, etc., are allowed to continuously act upon the chronically diseased bursa, a hygroma or chronic dropsy of the bursa is the result.

What changes take place in the bursa before it becomes a hygroma ?

The walls of the bursa and the parabursal tissue undergo chronic fibrous changes leading to more or less extensive thickening and induration of the walls, forming a firm connective tissue capsule.

Pathologically speaking, what process takes place ?

A chronic fibrous bursitis and chronic parabursitis.

Describe the hygroma of the olecranium bursa.

This condition, commonly called shoe boil, represents a globular, circumscribed, painless, hard, more or less pendulous mass at the point of the elbow. It is very common in the horse and is also seen in the larger breed of dogs.

Describe the hygroma of the calcanean bursa.

This is represented by a somewhat elastic, painless, circumscribed, globular swelling at the point of the os calcis, and may possibly be confounded with other pathological products peculiar to this part.

How can you differentiate the calcanean hygroma from pathological states simulating it?

A discussion of this subject does not belong to a work on general surgery (look up Mohler's "Special Surgery" for that purpose).

Outline the treatment of bursal hygroma.

The practically fibrous mass of an olecranian hygroma is either ligated *en masse* or allowed to drop off, of course employing proper antiseptic measures at the same time. This form of treatment is not very desirable. Very large ones, when a removal is required, are best excised, while those as large as two fists can be puckered up to almost nothing by puncturing them with the thermocautery as described under "Outline the treatment of purulent bursitis."

Inflammation of the Muscles (Myositis).

Depending on the cause, what forms of myositis are recognized?

Rheumatic, traumatic, infectious and parasitic.

What is a specific myositis ?

The inflammation of a muscle due to a special bacillus or parasite.

Give an example of specific myositis.

When due to the trichina spiralis, it is termed trichinous myositis (*myositis trichinosa*); when due to the ray fungus, *myositis actinomycotica* ; when due to the bacillus of tuberculosis, it is termed *myositis tuberculosa*, etc.

Depending on the course, what forms of myositis are known ?

Acute and chronic.

According to the character of the exudate, what forms of myositis are known ?

Serous, purulent and their subvarieties.

Depending on the character of the inflammation, what forms of myositis are known ?

Interstitial, parenchymatous.

What do you understand by an interstitial myositis ?

It is a myositis of chronic nature accompanied with connective tissue proliferation mainly in the internal perimysium, which gradually replaces the muscular substance.

What is a parenchymatous myositis ?

A myositis involving the muscular substance proper (primitive muscle fibers, muscle columns and muscle cells).

According to the origin, what forms of myositis are known ?

Primary or secondary (also termed metastatic).

Give some examples of secondary myositis.

Metastatic myositis is represented by tubercular myositis, actinomycotic myositis, equine streptococcus distemper, etc.

What forms of myositis are of practical interest to the surgeon ?

1. Traumatic serous myositis.
2. Purulent myositis.
3. Interstitial myositis.
4. Ossifying myositis.
5. Muscular rheumatism.

TRAUMATIC SEROUS MYOSITIS.

In what animal is it most frequently seen ?

In the horse.

What are its causes ?

Contusions, as in runaways, railroad transportation, over-extension, contiguous inflammations.

What course does traumatic myositis usually take ?

An acute course ; more rarely a chronic one.

What changes take place in a muscle in acute serous myositis ?

As the result of the inflammation a serous or hemorrhagic exudate invades the external and internal perimysium, to be replaced by cellular infiltration, as in inflammation of other organs. The muscle fibers are either left undisturbed or undergo granular and fatty degeneration, which, of course, terminates their life period. In those cases followed by resolution—that is, prompt recovery—the contractile elements remain intact, while in those cases taking a chronic course the connective tissue of the perimysium proliferates gradually, crowding the contractile substance out of existence.

Which muscles are especially exposed to traumatic myositis?

In the horse, the mastoido-humeralis, on account of its prominent position, giving rise to a marked shoulder lameness. In swine and cattle, when shipped by rail, and especially when an undue number is put into a car, contusions are common, especially of the muscles of the shoulder, croup and breast.

What are the symptoms of traumatic serous myositis?

A circumscribed painful area, with more or less swelling, impaired function and increase of temperature of the parts.

Outline the treatment of traumatic serous myositis.

Rest, hot applications ; later, stimulating liniments where the rubbing of the parts—that is, massage—is the most important therapeutic point ; blisters.

PURULENT MYOSITIS.

What are the causes of purulent myositis?

This form starts with an infection of a wound of the muscular tissue, either leading to a phlegmonous myositis or abscess formation.

What changes take place in the muscular tissue in purulent myositis?

The perimysium becomes necrotic, the adjoining fascia may undergo necrosis and the muscular fibers die ; the necrotic area varying in extent according to the intensity of the infection. Thus results either a diffused septic cellulitis or simply an abscess.

What important sequels are likely to follow purulent myositis?

Septicemia, pyemia, fistulæ, abscess.

Give a common example of purulent myositis.

The so-called shoulder abscess of the horse.

How is this shoulder abscess formed ?

The large, circumscribed globular swelling, at times the size of a man's head, either develops in the mastoido humeralis at the point of the shoulder, or in the lymph glands right below the muscle, but always involving it. It seems that two factors are actively concerned in the production of this abscess. Pathologically speaking, it represents a purulent myositis, the pus being enclosed by a fibrous capsule of variable thickness, which capsule again is the result of an interstitial myositis. Contusion and subsequent infection with pus-producing germs are essential etiological factors. It is my experience that the vast majority of these deep and chronic abscesses are found on the right side of the horse, which supports the assertion that bruising is necessary for the entrance of bacteria belonging to the streptococci and staphylococci, and at times botryomyces. Most likely the contusion lowers the vitality of the tissues, the germs being carried into them by the lymph channels, where they develop either in the mastoido humeralis, producing a cellular infiltration and next an abscess, or the germs are deposited in the lymph glands below the muscles, in which case there is a primary chronic suppurative lymphadenitis with a secondary chronic interstitial myositis.

Name some diseases where multiple metastatic muscle abscesses are seen.

In the streptococcus distemper of the horse and in pyemia.

Outline the treatment of purulent myositis.

Incise the parts and secure drainage, and employ anti-

septic measures. In the shoulder abscess do not waste time with external applications, but slit the indurated muscle open and if necessary open the pus cavity with a boring motion of the extended finger.

INTERSTITIAL MYOSITIS.

What is interstitial myositis ?

It represents a chronic inflammatory process with connective tissue proliferation mainly of the internal perimysium, which gradually replaces the contractile substance, as a result of which the muscle becomes shorter and harder.

What are the causes of interstitial myositis ?

The etiology of this myositis is still a little obscure. It seems that parasites and bacteria play an important rôle.

Where is it commonly seen ?

In chronic muscular rheumatism, in traumatic purulent states of the muscles, in specific infection, as actinomycosis and muscular atrophy, etc.

OSSIFYING MYOSITIS.

What is an ossifying myositis ?

A myositis of rare occurrence, where the connective tissue—that is, the perimysium—is gradually changed into bony tissue, which, as the result of its development, causes degeneration and atrophy of the muscular fibers.

How is this ossifying myositis explained ?

There are two forms. In the primary ossifying myositis, one deals with a neoformation ; in other words, an osteoma—that is, a bony tumor—is directly developed. In secondary ossifying myositis, the ossification of the perimysium is a secondary process, there being first the formation of exostoses at

the bony origin or insertion of such a muscle. It seems that the connective tissue constituents of a muscle which are near bony insertion, and where the osseous changes are mainly observed during their original development, are endowed with periosteal-like properties, as the bony process is identical with bony formation, such as is seen to come from the periosteum.

In which animals has ossifying myositis been observed ?

Horses, dogs and swine.

What is the treatment ?

None ; the disease is incurable.

MUSCULAR RHEUMATISM.

What is muscular rheumatism ?

An acute serous myositis at first, with a strong tendency toward chronicity, in which case it leads to a chronic interstitial muscular inflammation.

What is the cause of rheumatic myositis ?

Mainly exposure to cold and damp.

What changes take place in the affected tissues ?

In acute muscular rheumatism the changes peculiar to serous myositis, while in the chronic form those accompanying interstitial myositis are seen.

What animals are mainly subject to rheumatic myositis ?

Dogs, cattle and horses.

What muscles are more frequently involved ?

The mostoido humeralis, the cervical and lumbar and gluteal muscles and intercostal muscles.

What are the symptoms of rheumatic myositis ?

In torticollis, the cervical muscles being involved, the neck is held to one side, all movements avoided ; palpation is painful. In case the mastoido humeralis is diseased, there is distinct shoulder lameness, the animal improving on exercise. In pleurodynia, where the intercostal muscles are inflamed, there is dyspnoea, the animal grunts when the intercostal spaces are palpated, while rheumatic myositis of the lumbar muscles and those of the gluteal region causes a stiff and painful gait, especially painful on palpation in dogs.

What is peculiar to rheumatic myositis ?

It has a tendency to shift from one place to another, is strongly recurrent and tends to chronicity.

Outline the treatment of rheumatic myositis ?

In acute cases, warm, moist applications, later stimulating applications and sodium salicylate internally. In chronic cases in the horse, hypodermic injections of veratrin are indicated.

Rupture of Muscles.

In what animals is the tearing of muscles mainly observed ?

Horse and ox.

What are the causes ?

As a result of previous diseases, the muscular fibers may have undergone granular degeneration, thus weakening the muscle and predisposing it to spontaneous lacerations (same as seen in tendons). Direct causes are strong traction on a muscle, undue and sudden unopposed contractions, blows.

To what extent do muscles rupture ?

All the way from a slight tear to complete pulpification.

Which muscles are mainly ruptured ?

Most commonly the flexor metatarsi, next the abdominal muscles, as the rectus obliquus and transversus abdominis ; next, the triceps femoris, the gluteal muscles, gastrocnemius, biceps femoris, flexor brachii, mastoido humeralis.

Outline the treatment of rupture of muscles ?

Rest ; and for the benefit of a restless owner, some external application.

How does an aseptic muscle rupture heal ?

The exuded blood is absorbed. Proliferations take place in the external and internal perimysium, filling the gap. This scar tissue retracts more or less in due time, and a depression can be seen and felt in the muscle at the point of former rupture.

What symptoms does a ruptured muscle produce ?

This depends entirely upon the muscle involved. Thus, rupture of the abdominal muscles is followed by a hernia, rupture of the muscles of the locomotory apparatus gives rise to lameness. In the earlier stages palpation may locate a distinct gap between the ends, or in cases of some standing this is hidden by an extravasation of blood, swelling and pain, and impaired or lost function.

Which symptoms does rupture of the flexor metatarsi give rise to ?

The same as that of its tendon, which see. Prognosis is favorable ; the process of healing requires about one month to six weeks.

What symptoms does rupture of the gastrocnemii produce ?

The same as that of their tendon, which see. The prognosis is unfavorable ; complete recovery is rare.

What symptoms does rupture of the triceps femoris produce ?

Being the mainstay of the femoro tibial articulation, the rupture of this compound muscle no longer holds the stifle up and the animal acts as in paralysis of the crural nerve as it is seen in hemoglobinemia (azoturia) ; that is, it gives way in all articulations of the leg.

What symptoms does rupture of the mastoido humeralis cause ?

Swinging-leg lameness, being usually the result of some contusion ; infection of that place often takes place, followed by abscess formation at the site of rupture.

What symptoms does rupture of the abdominal muscles produce ?

It is followed by a hernia of variable size.

Atrophy of Muscles.

Give the etiology of muscular atrophy.

Generally speaking, the true muscular elements may decrease in size and numbers as the result of disuse, articular diseases or interference with the nerve supply of the affected muscle, or of a generally depraved state of the blood.

What forms of muscular atrophy are of interest ?

Simple atrophy, degenerative atrophy, lipomatous atrophy.

What do you understand by simple atrophy ?

A diminished size of muscles due to a decrease in size and numbers of the muscular fibers, but without degenerative changes of the fibers.

What are the causes of simple atrophy?

In certain chronic lamenesses, the result of articular diseases, as in spavin or ringbones, wasting of the muscles of the croup or shoulder is common. In this instance muscles atrophy on account of a reflex disturbance of the trophic nerves, and, second, on account of inactivity—that is, enforced quietude of the affected muscle.

Can you give a positive testimony as to the length of time a part is atrophied?

In the vast majority of cases of muscular wasting, it is impossible to conscientiously state the age of an atrophy. It can only be approximated, which, of course, is of little value from a forensic point of view.

Why can you not give a positive answer as to the age of an atrophy?

Because the muscles of some animals waste away more quickly than those of others, because the atrophy becomes more quickly evident the fatter the animal, and the greater the lameness. Marked atrophy of muscles in fat animals is sometimes seen to take place in two to four weeks.

DEGENERATIVE ATROPHY.

What is degenerative atrophy?

A decrease in size and numbers of the muscular elements with destruction of the contractile substance and fatty degeneration of the same.

Which are the common causes of degenerative muscular atrophy?

Peripheral nerve paralysis and nutritive disturbances due to serious infectious diseases.

Give some examples of degenerative atrophy.

Atrophy of the spinatus muscles follows paralysis of the suprascapular nerve ; paralysis of the radial nerve leads to wasting of the triceps extensor of the forearm. Paralysis of the recurrent laryngeal nerve in some instances causes arytenoid hemiplegia and atrophy (roaring), while in the hindleg paralysis of the crural nerve produces atrophy of the triceps femoris. Atrophy of muscles due to inflammatory processes producing serious nutritive disturbance find their best example in azoturia (hemoglobinuria).

LIPOMATOUS ATROPHY.

What do you understand by lipomatous atrophy ?

This is the only form of atrophy where the volume of the muscle increases in size, explained as follows : In the connective tissue between the primitive muscular fibers an excessive amount of adipose tissue develops, which, by its pressure, leads to atrophy of the contractile substance. It is the large amount of fat thus formed which increases the size of the muscle, while in reality the muscular elements proper are being more or less destroyed.

Give an example of lipomatous atrophy.

Commonly seen in animals fattened for the market. It is a well known fact that fat pigs or cattle are unable to stand any exertion, simply due to the depraved state of the muscular system.

Outline the treatment of muscular atrophy.

In simple atrophy a nourishing diet with regular work, hand rubbing and possibly stimulating applications or injections of strychnine or veratrine are indicated. In degenerative atrophy the contractile substance is destroyed and not

to be replaced. Here the treatment consists in preventing further progress of the degenerative changes, by producing a compensatory hypertrophy of the contractile elements still present. The best results in cases of recent atrophy are intramuscular injections of a sterile, saturated, aqueous, NaCl solution. In chronic cases, injections of an aqueous, saturated solution of bichloride of mercury gives excellent results ; in the latter instance excessive swelling, which occasionally follows it, is controlled by internal doses of potassium iodide. Injections of turpentine are often followed by violent symptoms and are best omitted.

DISEASES OF APONEUROSSES.

What rôle do the diseases of aponeuroses play in surgery ?

They play a very important part, giving rise to long-lived fistulæ when undergoing purulent changes ; they act as a support to the muscles which they cover, and when torn a so-called muscular hernia is the result. In cattle, dislocation of the biceps femoris is at times the result of an aponeurotic rupture. Having a limited blood and nerve supply, and being composed of fibrous tissue, they are very liable to necrosis, their vitality being small. Their structure itself does not render them liable to inflammatory processes ; thus they act as guards against contiguous inflammations to the muscles below or above them, but this very firmness also causes them to permit septic inflammatory processes to become diffused, phlegmonous processes spreading readily in the space formed between the aponeuroses, which space is termed the subfacial space, and any inflammatory process taking place in this subfacial space is known as subfacial cellulitis. Otherwise the aponeurosis is actively concerned in the circu-

lation of the blood and lymph, producing a sort of pumping effect by their contractions and relaxations.

Necrosis of Aponeuroses.

What are the causes of aponeurotic necrosis ?

Intermuscular and subfacial purulent cellulitis, usually the result of purulent wounds of muscles.

Why are aponeuroses subject to prolonged necrosis ?

Because their powers of regeneration are very limited; because they are deeply located, rendering drainage difficult, thus allowing them to be continuously exposed to the irritating action of pus; because they are very firm, rendering decided resistance to exfoliation of the necrotic part; and, finally, because they are extensive, offering a large area to infection.

To what extent are aponeuroses usually necrotic ?

More commonly the necrotic process is circumscribed, but diffused necrosis is also seen.

What are the symptoms of aponeurotic necrosis ?

A fistulous tract leads to the necrotic part.

Which anatomical regions are common examples of aponeurotic necrosis ?

The poll (poll evil), fistulous neck and withers, fistulæ about the croup.

Outline the treatment of aponeurotic necrosis ?

Caustic injections have their advocates, but I do not advocate them. Lately, protargol has given me very good results, but above all stands the knife. Of course the knife-shy surgeon will be disappointed. Deep and long incisions, utter removal of everything which is necrotic, must be the battle cry, with subsequent drainage and antiseptic treatment.

Rupture of Aponeuroses.

What are the causes of aponeurotic rupture ?

External traumatisms, as blows, kicks, etc.

What are the symptoms of aponeurotic rupture ?

When the aponeurosis covering a muscle is torn by an external assault, a portion of the muscle covered by the aponeurosis bulges out through the rent in the aponeurosis, palpation showing the firm edges of the split in the aponeurosis with the soft muscular substance in the center.

Retraction of the Tibial Aponeurosis.

What importance is attached to retraction of the tibial aponeurosis ?

By some authorities retraction of the tibial aponeurosis is given as the cause of stringhalt.

Does this assertion prove true ?

By no means. Some stringy horses make a recovery when section of the aponeurosis is made, especially when combined with section of the peroneal tendon. Others do well when the internal lateral ligament of the patella is cut ; again, other authorities attribute stringhalt to nervous diseases.

What do you understand by pseudo stringhalt ?

False or symptomatic stringhalt represents a snatchy movement of the hindlegs of horses, accompanying such conditions as eczematous or gangrenous dermatitis (scratches), ringbone, spavin, coronary caulking, etc.

DISEASES OF NERVES.

Paralysis.

What do you understand by paralysis of a nerve ?

Complete cessation of the functional activity of the nerve.

What do you understand by paresis ?

Impaired functional activity of a nerve.

According to the origin, what forms of paralysis are recognized ?

When originating in the brain, it is termed cerebral paralysis ; when in the spinal cord, it is called spinal paralysis ; when originating in a nerve trunk—that is, the nerve after it leaves the spinal canal—it is known as peripheral paralysis.

According to the extent of the paralyzed area, what forms of paralysis are given ?

In hemiplegia, one side of the body is paralyzed ; in paraplegia, both sides are affected ; in monoplegia, a muscle or set of muscles, or a single leg, is paralyzed.

What psychological facts are of special interest in nerve paralysis ?

A voluntary contraction of a muscle requires, first, a motor impulse generated in the psychomotoric centers in the gray matter of the cerebral cortex ; this is conducted downward by the motor fibers, which decussate at the medulla oblongata ; that is, those fibers originating on the right side cross over to the left side and vice versa (which explains the fact that a hemiplegia, for instance, affecting the right side of the body finds its active cause in some pathological state of the left side of the brain). After decussating, the motor

fibers run downward in the lateral columns of the spinal cord, a great many of them becoming connected with the large multipolar cells in the inferior horns of gray matter ; from here the motor impulse is transmitted by the inferior root, which, together with the superior root, the sensory one, constitutes the spinal nerve leading to the skin, muscles or viscera.

Into what two large divisions may the motor tract be subdivided ?

1. The cerebro-spinal tract—that is, the one beginning in the motor centers of the cerebrum and ending, so to speak, in the large multipolar cells of the inferior gray horn. 2. The peripheral tract—that is, the one beginning with the inferior and superior root and extending to the periphery—that is, the muscles.

What are the causes of paralysis ?

Peripheral paralyses are usually due to some traumatism, as contusions, lacerations, stretching; cerebral and spinal paralyses more generally are due to cerebral and spinal diseases.

What general symptoms does a paralyzed muscle exhibit?

Voluntary contractions are either impaired (paresis) or impossible (paralysis). As a rule, the paralyzed muscle is flabby and does not oppose passive movements. But the paralyzed muscle may be reflexly stimulated and appear in a state of continuous contraction. Usually the paralyzed muscle atrophies more or less rapidly.

What deduction can you make from reflex movements taking place through the spinal cord ?

By artificially producing reflex movements of muscles one can determine the condition of the various segments of the spinal cord.

How is the more or less rapid atrophy of a paralyzed muscle explained ?

When the functional activity of the motor tract is interrupted before the motor fibers connect with the large multipolar cells in the inferior gray horn of the spinal cord, the nutrition of the paralyzed muscle is only disturbed by the inactivity of that muscle ; in other words, there is an inactivity atrophy and no degenerative changes in the muscular fibers themselves, simply because the trophic motor ganglia—that is, the multipolar cells in the gray horn—are not disturbed in their nutritional influence which they exert over the nerve and muscle. But as soon as these ganglia themselves are diseased, or the active cause of the paralysis lies back of them, thus interrupting their nutritional influence over the nerve and muscle, a rapid degenerative atrophy sets in.

Of what value are these points in regard to the prognosis of a paralysis ?

In inactivity atrophy, the nutrition of the nerve and muscle not being interfered with, restitution under certain circumstances is possible; while in those cases of paralysis with destruction of the trophic elements of the nerve and muscle, permanent and irreparable damage renders the prognosis unfavorable, as far as the muscle and nerve are concerned.

What do you understand by the reaction of degeneration ?

A modification in the electric properties of paralyzed nerves and muscles.

What do you understand by the electrical properties of muscles and nerves ?

Healthy nerves and muscles, when exposed to electric stimulation, respond to it in a precise manner. When dis-

eased, the electric conductivity of nerves and their muscle endings produces alterations in their reactions to electric stimuli.

Of what value is the reaction of degeneration to the surgeon?

It is very important in the diagnosis and prognosis of a paralysis.

What forms of electricity are used to test electric properties of muscles?

The induced or faradic current and the constant or galvanic current.

What does the presence of the reaction of degeneration indicate?

It points positively to structural changes in the diseased parts.

How soon does a paralyzed nerve lose its electric excitability?

In about fourteen days.

How soon does a muscle lose its electric excitability?

Muscles soon cease to react to the faradic current, while when exposed to the galvanic current their excitability is at first increased, to lose itself in four to eight weeks—that is, the muscular contraction becomes slower and slower at the make and break of the constant current (as the current is allowed to pass or is interrupted).

Upon what features is the diagnosis of cerebral paralysis based?

The paralyzed area is, as a rule, extensive—hemiplegia; but may be a monoplegia, only involving one cranial nerve; then reflex action is present and degenerative atrophy is wanting.

What are the essential features of a spinal paralysis ?

As a rule, both sides of the body are involved (paraplegia). Reflex movements may be absent, excessive or normal. Atrophy of the affected muscles may be wanting or highly developed (depends upon the seat of the active cause ; for this reason the reaction of degeneration may or may not be present).

Which are the peculiarities of peripheral paralysis ?

As a rule, certain groups are involved (monoplegia). Reflex movements soon cease to exist, degenerative atrophy of the paralyzed muscles is common ; the reaction of degeneration is present.

What points do you consider in establishing the seat and cause of a paralysis ?

The development, course and extent of a paralysis.

What deductions can you make from the development of a paralysis ?

When developing suddenly it suggests a traumatism, while slow development indicates a tumor or strangulation of the nerve by scar tissue.

Which peripheral paralyses are of special surgical interest ?

1. Suprascapular nerve paralysis. 2. Radial paralysis. 3. Crural paralysis. 4. Facial paralysis. 5. Paralysis of the motor branch of the trigeminal nerve.

Which are the peculiarities of suprascapular nerve paralysis ?

At the moment the leg supports weight the scapula is suddenly jerked away from the thorax. Later follows atrophy of the antea and postea spinatus and teres major. The prognosis is unfavorable, as most cases do not recover.

What are the peculiarities of radial paralysis ?

Complete inability to support weight with the leg. The paralyzed triceps extensor appears flabby and atrophies later. Prognosis is favorable.

What are the peculiarities of crural nerve paralysis ?

Since the triceps femoris is paralyzed the leg breaks down in the attempt to support the weight of the body. Later the muscle atrophies materially. Those due to trumatisms have a favorable prognosis.

What are the peculiarities of facial paralysis ?

The paralyzed muscles are drawn over to the other side of the face by their antagonists ; food accumulates between the cheeks and teeth ; the upper eyelid hangs down.

What are the peculiarities of paralysis of the motor branch of the trigeminal nerve ?

Apprehension of food is difficult, the muscles concerned in mastication are paralyzed and atrophied, there is ptyalism, food accumulates in the buccal cavity, the lower jaw hangs down.

Which points do you consider in making a prognosis ?

Decided atrophy and a paralysis of long standing demand an unfavorable prognosis. When the paralyzed muscles do not respond to the faradic current and atrophy is marked the prognosis is unfavorable.

Peripheral nerves exposed to serious traumatism are often incurable. I have had several cases of radial paralysis which required from nine to eleven months for recovery.

Slight traumatism entitles to a favorable prognosis.

A paralyzed muscle responding to the faradic current after the fourteenth day of its paralysis, as well as one exhib-

iting a hyperaesthesia on application of the faradic current, entitle to a favorable prognosis.

Generally speaking, paralyses of the facial and radial nerves are more favorable for a recovery than those of the crural or suprascapular nerves.

Treatment of Nerve Paralysis.

What do you mainly strive at in the treatment of paralysis ?

1. To relieve the injured nerve from the direct cause of its paralysis. This is rarely possible, most nerves being beyond reach.

2. To keep up the nutrition of the paralyzed muscle.

As long as the muscle reacts to the faradic or galvanic current it is well to apply it. But most animals, and especially horses, soon become very unruly on the application of electricity, and other agents have to be employed to prevent atrophy as far as such is possible. The next best agent is persistently applied massage, blisters, setons, hypodermic injections of strychnine and veratrine, saturated aqueous solution of sodium chloride, or bichloride of mercury ; veratrine must be used with care, as overdoses do not revive, but, on the contrary, fatigue and paralyze muscles.

Inflammation of a Nerve (Neuritis).

What are the causes of neuritis ?

Traumatisms, infection, toxic agents.

Is neuritis often seen in animals ?

It does not occur often, except certain forms of neuritis of the eye. A great many authors claim that hemiplegia laryngitis (roaring) is the result of neuritis of the recurrent nerve, due to at first a pleurisy, the inflammation extending

to the recurrent nerve, where it turns from left to right behind the arch of the aorta. That this is by no means the only cause of this important condition—roaring—the classical investigations of Prof. Thomassen, Utrecht, now conducted by him, tend to show.

What are the symptoms of neuritis?

Injury of the nerve fibrils may lead to sensory or motor disturbances. Depending on the severity of the lesion, the symptoms are either those of irritation or destruction—that is, neuralgia or anesthesia, spasm or paralysis.

Outline the treatment of neuritis?

Anodynes, counter-irritants, and, as a final, neurectomy.

To what extent does the combined injection of cocaine and morphine influence neuritis?

During the past five years I have had several cases of chronic lameness in which I was unable to find pathological lesions sufficiently severe to satisfy me as to the cause of the intermittent supporting-leg lameness which the horses exhibited. Two were lame behind and had been treated for several months with liniments and blisters by other gentlemen. The first one had injected a cocaine-morphine mixture over the posterior tibial nerve. The owner not having any use for him, rested him for two days, reporting the animal perfectly free from lameness a few days later. The second one was injected twice a week for two weeks and has remained free from lameness since. The other cases were lame in front, showing a moderate low lameness. In order to settle this question, I injected them over the high plantar neurectomy site. In all of them lameness was much less after the first injection on the following day than previously. These injections were repeated three to four times before the lameness finally disap-

peared. Of course I have injected lots of horses without getting any results but temporary ones, and these were simply neurectomized subsequently.

Therefore, it seems proper to employ a cocaine-morphine injection with a view to produce a cure in these and similar cases instead of neurectomizing the patient at once.

What changes take place in a neurectomized nerve?

The whole of the peripheral part of the nerve—that is, that portion severed from the nerve trunk—undergoes granular and fatty degeneration; one may term it a descending degeneration; while from the central stump gradually a collateral anastomosis is established, eventually endowing the peripheral parts with limited nerve supply. But in those cases where the neurectomy wound has undergone purulent changes, and as the result of pus formation granulations became established and the nerve amputated below the upper wound commissure, thus allowing pinching and tugging upon the central nerve stump, interstitial inflammation of a chronic nature is the result and consequently a false neuroma.

DISEASES OF ARTERIES.

Arteritis.

What is arteritis?

Inflammation of an artery.

Name the varieties of arteritis.

1. Endarteritis (inflammation of the inner coat).
2. Mesarteritis (inflammation of the middle coat).
3. Periarteritis (inflammation of the external coat).

What forms of arteritis are recognized?

According to the course of the inflammation, it may be

acute or chronic, aseptic or septic (purulent). According to its origin, it may be traumatic or hematogenous.

Is arteritis a common surgical disease ?

It is comparatively rare, especially the chronic form, also known as chronic deforming or atheromatous arteritis.

Which variety of arteritis is of most practical interest ?

Acute septic or purulent arteritis.

How is an acute septic arteritis produced ?

The arterial walls are infected with pus-producing bacteria as follows :

1. In septic diseases an infected embolus may become lodged in an artery and excite a purulent inflammation of the internal coats, which are swollen and infiltrated with pus cells.

2. A purulent inflammation of the surrounding parts may spread to the adventitia and a purulent periarteritis results.

3. The intima, some way or other, becomes injured and a purulent thrombus forms at that point, a condition termed purulent endarteritis.

What is chronic deforming arteritis ?

It is a chronic endarteritis followed by fibrous changes, fatty degeneration, cheesy collections and calcareous deposits in the arterial walls, as a result of which the walls of the artery become hard and inelastic ; may even rupture the lumen of the vessel ; may become narrower or even obliterated.

In which animals is chronic arteritis exemplified ?

In the horse it is the result of the presence of the strongylus armatus in the mesenteric arteries.

Aneurism.

What is an aneurism ?

It is a pulsating tumor containing blood, which communicates with the interior of an artery.

Classify aneurisms.

Idiopathic, traumatic.

How do you divide idiopathic aneurisms ?

Cirroid, tubular, sacculated, dissecting.

What is cirroid aneurism ?

This is really no aneurism at all, but a neoformation, a blood tumor. The vessel is tortuous. The shape of the blood tumor is irregular, compressible, pulsating and bluish, involving, as a rule, a number of arteries held together by connective tissue.

What is a tubular aneurism ?

It is an elongated dilatation of an artery involving all three coats of the artery.

What is a sacculated aneurism ?

Consists of a pouch-like dilatation, springing from the side of an artery.

How do you subdivide a sacculated aneurism ?

Into a true and false aneurism.

What do you understand by a true and false aneurism ?

In the true sacculated aneurism, all three coats of the artery are distended and form the sac. In the false aneurism the wall of the pouch is practically made up of the adventitia only, which has undergone connective tissue proliferation.

What is a dissecting aneurism ?

Here the internal arterial coat gives way usually at a point which has undergone atheromatous changes. The blood enters at this point, burrows along through the middle coat, finds in its course another atheromatous patch, and thus either reënters the current or extravasates into the surrounding adventitia.

What is an aneurismal varix ?

A direct communication with an artery and vein.

What are the causes of aneurisms ?

The most common cause in the horse is a pin worm, the *strongylus armatus*, giving rise to a verminous aneurism in the mesenteric arteries, especially the anterior mesenteric artery, where the parasite produces a chronic deforming endarteritis and as a result of this an aneurism, also emboli and degenerative changes in the arterial coats, as a result of which the resisting power becomes limited, thus predisposing to an aneurism when the blood pressure becomes excessive, as by violent efforts, sudden strains, etc.; finally, traumatisms, as punctures.

Are aneurisms often seen in animals ?

Aneurisms of surgical interest are quite rare, and of all animals the horse exhibits them most frequently.

In which arteries of the horse are aneurisms of surgical interest ?

Submaxillary, carotid, nasal, brachial, aorta, iliac and femoral arteries.

Which symptoms do aortic aneurisms give rise to ?

In the horse, aneurisms attaining the size of a man's head are occasionally seen at the origin of the common aorta.

—that is, opposite the sigmoid valves ; in other words, at the sinus of the aorta, because this point is exposed to decided blood pressure. Such an aneurism may form adhesions with the neighboring organs, as stomach, liver, etc., or may even produce atrophy of the vertebral columns by its pressure against it. As a rule, they do not produce any symptoms at all during the life of the animal, but may lead to a rapid death by rupturing and internal hemorrhage. In other instances, they have given rise to vertigo, dyspnœa, staggering. Those horses which bleed to death as a result of a ruptured aneurism, stop suddenly, gasp for breath, fall down and die quickly, the immediate cause of the rupture being an extra muscular effort.

Describe aneurisms and thrombosis of the posterior aorta.

The seat of predilection seems to be the quadrification of the aorta. Here an aneurism is either the result of an endarteritis, or an embolus obstructs the vessel, coming from a thrombus located in some other vessel. Such an embolus may be swept on further and obstruct the iliac or femoral arteries.

What anatomical changes are seen in the aorta under these circumstances ?

The walls of the aorta are thickened ; the intima especially has undergone fatty and calcareous changes, also exhibiting ulcerations. The interior of the artery is more or less obstructed by a thrombus of light color, which may extend anteriorly or posteriorly into the iliac arteries or even femoral artery.

What symptoms does dilatation and thrombosis of the posterior aorta produce ?

Rare in the ox, less so in the horse. When standing still or while walking slowly, nothing unusual is noticed. As soon

as the animal is exposed to active exercise, one or both hindlegs begin to sway, get weaker and weaker, the leg or legs seem to lose all power, the animal knuckles over and finally falls down, the heart beats violently, respiration is hurried and difficult. The whole body is covered with sweat, the mucous membranes are very red. After a little while all these symptoms lose themselves and the animal gets up none the worse, to repeat the performance when once more exposed to active exercise. Rectal palpation reveals the thrombosed artery as a hard, inelastic, dilated, longish object, with either no or decreased pulsation below the thrombus. Palpation of the paralyzed leg, as a rule, shows a wanting pulsation of the peripheral arterial branches and an icy coldness.

What symptoms do dilatation and thrombosis of the internal iliac arteries produce?

The most marked ones are paralysis of the bladder, rectum, coccygeal muscles.

What symptoms do dilatation and thrombosis of the brachial artery produce?

The muscles of the affected foreleg tremble, the animal stumbles, finally drags the leg, may even fall down. In these cases, violent beating of the heart, dyspnoea, generalized sweating, are, as a rule, absent.

Give an example of aneurismal varix.

In rare instances, where jugular phlebotomy is unskillfully practiced, the carotid artery may be punctured and thus adhesions between it and the jugular vein—an aneurismal varix—arises.

Outline the treatment of aneurisms.

When possible, the artery ought to be ligated above and

below the aneurism and the latter severed, provided that the artery is within reach and that by doing so the arterial supply is not entirely cut off from the parts normally supplied by it, as otherwise the peripheral parts would undergo necrosis, being brought into a state of permanent anemia by the ligatures. Other means of value in human surgery, as elastic bandages, compression, injections of ergot, tincture of iron, etc., are of no special value in veterinary surgery. Those cases of aneurism of the posterior aorta, iliac arteries or femoral and brachial arteries are beyond reach, although some authors suggest iodide of potassium and massage, the former being of doubtful value, while the latter is simply dangerous.

Rupture of Arteries.

What are the causes of rupture of the larger arteries?

The various causes may exert their influence in a twofold manner. The assaulting agent may be directly or indirectly responsible for the rupture of the artery. In the former, the cause, a traumatism, directly injures the artery; in the latter, a diseased state of the arterial wall of the vessels disposes it to ruptures, as the resisting powers of the arterial walls are lessened. Such indirect causes are falls and consequent concussion, excessive muscular efforts, etc.

Which pathological states of the arterial walls predispose them to rupture?

Chronic deforming endarteritis, aneurisms and the destructive influence of neighboring neoformations.

What do you understand by spontaneous rupture of arteries?

An arterial rupture, the result of an indirect cause.

The ruptures of which larger arteries and veins are of clinical interest ?

The seat of predilection of the aorta is at the aortic sinus. As previously stated, blood pressure is excessive here, there is naturally some dilatation, the walls are somewhat thin. In cases of rupture at this point, the blood empties into the pericardium. The more common causes are : throwing an animal for an operation, fast running and jumping, wagon poles entering the thorax. Rupture of the pulmonary artery, the result of throwing the creature, has also been observed ; rupture of the obturator artery sometimes follows pelvic fractures ; rupture of the anterior mesenteric artery, especially when affected with an aneurism, has been known to follow the throwing of a horse. Of the veins, the vena cava and portal vein occasionally rupture.

What are the symptoms of rupture of the larger arteries and veins ?

Mucous membranes very pale, extremities cold, breath cold, pulse very weak and soon beyond detection; the animal sways and falls ; occasionally convulsions.

Outline the treatment of rupture of an artery ?

Whenever possible, the bleeding vessel should be ligated, but in the majority of cases the animal will bleed to death, as the vessels are beyond reach.

DISEASES OF VEINS.

Inflammation of Veins (Phlebitis).

Name the varieties of phlebitis.

1. Endophlebitis (inflammation of the inner coat).
2. Mesophlebitis (inflammation of the middle coat).
3. Periphlebitis (inflammation of the external coat).

What forms of phlebitis are recognized?

The course of the inflammation may be acute or chronic, aseptic or septic ; according to its origin, it may be traumatic or hematogenous.

Is phlebitis a common surgical disease?

In former times, when asepsis was little understood, it was very common, especially jugular phlebitis, the result of bleeding the animal with surgically unclean instruments, etc.; at the same time, phlebitis is much more common than arteritis.

Which form of phlebitis is of most practical interest?

Purulent phlebitis, also termed purulent thrombophlebitis.

How is purulent thrombophlebitis produced?

1. In septic processes near a vein, as in cases of progressive septic cellulitis, the purulent process may spread to the vein.
2. A venous thrombus may become infected from within—that is, through the circulation, as in pyemia—or pus-producing bacteria may enter from without.

Give some examples of phlebitis.

In colts and calves, as the result of neglected antisepsis of

the navel of the newly-born, the umbilical vein becomes infected and a most fatal thrombophlebitis sets in, a state commonly termed omphalophlebitis; phlebitis of the saphena vein as a result of cellulitis of the hindleg is also quite common. This phlegmonous condition of the hindlegs of heavily fed horses is usually termed lymphangitis. (This is not quite correct, as the lymphangitis is not a primary but a secondary pathological state, brought about by the absorption of irritants or toxic products of inflammation.)

Another example of thrombophlebitis of much clinical interest is the thrombophlebitis of the veins of the nasal mucous membrane.

Here the septum nasi shows little nodules, or small, elongated prominences of rosary-like arrangement of light to reddish gray color, surrounded by a darker zone. This condition has been mistaken for glanders, but each grayish nodule represents a white venous thrombus, and the fact that no ulcerations take place differentiates it from glanders.

What are the symptoms of phlebitis ?

The vein is swollen, painful and hard, possibly knotty; the surrounding tissues are edematous. In older cases a fistulous opening with a purulent discharge is seen—that is, in those which are superficially located, as, for instance, the jugular vein.

How do you explain the swollen and knotty state of the inflamed vein ?

The firmness of the inflamed vein is due to the formation of a thrombus and infiltration of its walls, while the knotty state is seen in those veins which are equipped with valves which, obstructing the flow of blood to a certain extent, encourage the development of the inflammatory process at

that place—that is, at the valves—and, as a consequence of this, the knots appear.

Outline the treatment of phlebitis.

Rest, laxatives in the earlier stages, astringent applications, later moist heat ; abscesses are to be opened and aseptised. In infectious thrombophlebitis intravenous injections of collargolum or tallianine may be of advantage. As a rule, all treatment is futile.

Varicose Veins (Varix).

What is a varicose vein ?

A permanent elongation of the lumen of a vein, the latter appearing tortuous and knotty.

What are the causes of varix ?

A predisposing moment lies in a sluggish return circulation, as is seen in the extremities, for instance; the most common cause is chronic endophlebitis, also traumatisms ; they may be congenital.

How common are varicose veins in animals ?

While more frequently seen than aneurisms, they are, on the whole, rare. Those reports of varicose veins of the rectal membrane (hemorrhoids) in the dog are mostly based upon a wrong diagnosis, being usually a diseased state of glands peculiar to the anus. At the same time, true varicose veins have been observed, as : hemorrhoids, milk veins of cows, upon the scrotum of dogs ; I have seen a varix of the spur vein of a mare ; finally, varicose veins on the spermatic cord are not uncommon.

Upon what do you base the diagnosis of varix ?

The presence of an elongated dilatation of a vein, knotty

or tortuous in its course, either circumscribed and then fusiform, tubular or sacculated in shape, or of a diffused character, is peculiar to varicose veins.

What becomes of varicose veins ?

They have a tendency to rupture and hemorrhage, formation of thrombus, which may even become calcified, forming a veinstone or phlebolith, or ulcerate.

Outline the treatment of varicose veins.

Ligation and excision of the varix is the most surgical treatment and gave me good results in the one case of varix of the spur vein which I met and operated ; others recommend the injection of carbolic acid, ergot, etc., into the perivascular structures—that is, the tissues about the vein.

DISEASES OF LYMPH VESSELS.

Lymphangitis.

What is lymphangitis ?

An inflammation of a lymph vessel.

What are the causes of lymphangitis ?

Lymphangitis almost invariably is caused by the entrance of septic bacteria or their products of metabolism into the opened lymph vessel.

Where is lymphangitis commonly seen ?

In the neighborhood of infected wounds, as the result of septic cellulitis, in fistulous withers, saddle galls, etc.

How do you explain this ?

Every tissue and organ is pervaded with lymph vessels. Their walls are thin and transparent, and adhere closely to

the surrounding tissue. Their function is to absorb, consequently septic products easily gain the circulation through them. Wherever a wound occurs, be it ever so minute, lymph vessels are also opened. The skin is endowed with superficially located lymph plexuses. Therefore, the smallest scratch is sufficient to permit infection, especially so on account of the hairy dress of animals, which swarms with bacteria of more or less virulence. For this very same reason also good results are obtained by antiseptic fomentations to the surface of the skin, as the antiseptic agent is taken up by them—that is, the superficial lymph vessels—and carried to the deeper lymphatics. For this reason, also, care must be exercised in applying strong antiseptic lotions over a large area of the smaller animals, as toxic effects may be obtained by their absorption.

What do you understand by specific lymphangitis ?

A lymphangitis, the result of the action of specific germs, as in farcy, by the bacillus malleus, as in the streptococcus distemper of colts, as in skin tuberculosis of cattle.

What changes take place in an inflamed lymph vessel ?

Whenever irritants, or, as is usually the case, infectious substances enter lymph vessels, coagulation of the contents and stasis take place. The endothelial lining of the intima inflames, and part of it is thus destroyed. The thrombus also decomposes and becomes mixed with the pus from the intima, and a cream-like mass fills the interior of the diseased vessel. The limited powers of resistance of the walls of the lymph vessels easily permit the exit or entrance of pyogenous material which invades the loose connective tissue about the vessel, start a purulent inflammation here, and an abscess is the result.

These abscesses along the lymph vessels show a rosary-like arrangement.

What are the clinical symptoms of lymphangitis ?

As the result of stasis and thrombosis in the lymph vessel, there is a painful firm swelling along the course of the lymph vessel in which the surrounding tissues participate more or less ; abscess may develop at more or less regular intervals along the course of the vessel. The regional lymph glands, in which more or less of the irritants become deposited, swell, while fever, the result of the entrance of the pyogenous material into the blood current, is also a feature.

Of course, not all cases of lymphangitis terminate with abscess formation ; a good example of resolution is the diffuse cellulitis and its secondary lymphangitis so commonly seen in the hindlegs of heavily fed and irregularly worked horses. I took occasion once before to state that the name given this disease in our country—that is, “lymphangitis”—was improper. No doubt this disease, the result of the entrance of some irritant into the lymph circulation either aseptic or otherwise, usually terminates favorably—that is, by resolution ; in other words, the irritant causing it is not sufficiently virulent to give rise to abscess formation, but, on the contrary, the contents of the diseased lymph vessel are absorbed and the parts return to almost their former state of vitality.

Outline the treatment of lymphangitis.

When due to an infected wound, prompt and thorough disinfection of the same is imperative. To prevent lymphangitis following surgical operations, which, while unnecessary, is yet frequently seen, antisepsis is essential. Moist antiseptic applications, provided they are persistently employed, give good results. As soon as an abscess forms it must be opened and drained and disinfected.

Lymphangiectasis.

What is lymphangiectasis ?

By it are understood varicosities and dilatations of variable extent of lymph vessels.

To what extent do they interest the veterinary surgeon ?

More from the standpoint of comparative surgery, as they are rarely seen in animals and belong to the domain of tumors.

DISEASES OF GLANDS.

Lymphadenitis.

What is lymphadenitis ?

. An inflammation of a lymph gland.

What are the causes of lymphadenitis ?

Any irritant, usually an infectious agent.

Why are lymphatic glands so prone to inflammation ?

The fact that they are reservoirs, receiving whatever material the lymph vessels gather, explains it.

How does septic material reach the lymph glands ?

First from without, via the lymph vessels ; in these cases there is also a lymphangitis present, the infection being carried there by the lymph vessels ; this form is known as lymphogenous adenitis. The second manner in which the septic material may reach the gland is through the blood current ; this form is termed hematogenous adenitis.

What is perilymphadenitis?

An acute purulent inflammation of a lymph gland involving the connective tissue surrounding the gland.

What is specific lymphadenitis?

Inflammation of a lymph gland due to specific germs, as glanders, tuberculosis, actinomycosis, equine distemper, etc.

What forms of lymphadenitis are of practical interest?

Depending on the cause, they may be traumatic or infectious as to their origin; lymphogenous or hematogenous, primary or secondary, as to the course, acute or chronic; as to the type of inflammation, purulent, parenchymatous, interstitial.

Which are the more common diseases productive of lymphadenitis?

Septic cellulitis, infected wounds, pharyngitis, nasal catarrh, empyema of the maxillary sinus.

Which lymph glands are often inflamed in horses and cattle?

In the horse: The submaxillary lymph glands, the glands underneath the mastoid humeralis at the point of the shoulder (shoulder abscess).

Cattle: The glands of the head and neck and those of the mammary gland.

Describe parenchymatous lymphadenitis.

In this form, the glandular tissue proper undergoes changes as a consequence of the inflammation, the blood vessels dilate and a serous exudate occurs; here the process may stop. There is swelling and pain due to the infiltration of the glandular tissue; as soon as this is absorbed the swelling recedes. But when the irritant is of sufficient virulence, the process goes on further, the glandular tissue becomes necrotic,

the process may possibly spread to the surrounding connective tissue and an abscess follows. In these cases where neither absorption nor abscess formation take place, a chronic lymphadenitis is the result.

Describe purulent lymphadenitis.

The infectious agent is of sufficient intensity to entail suppuration; almost invariably the surrounding connective tissue is involved in the inflammatory and suppurative process; the pus cavity thus formed rests in the connective tissue which encloses the more or less destroyed gland. In this form of adenitis the gland at first swells decidedly and is very painful, fluctuation appearing in due time, the pus being discharged either into the external world, or is absorbed, giving rise to septicemia or pyemia, or becomes inspissated. The most common example of purulent lymphadenitis is the streptococcus distemper of the horse.

Describe chronic interstitial lymphadenitis.

In this form of adenitis the interstitial connective tissue of the gland is primarily involved, as a result of which the gland becomes hard and nodular, often forming adhesions with the adjacent structures. Such a gland is not painful. As a rule, this chronic form is the result of an invasion of the gland with specific germs, as those of glanders, tuberculosis, but also accompanies chronic catarrhs of the upper respiratory tract.

Outline the treatment of lymphadenitis.

The parenchymatous form is best treated with moist heat and later with absorbents; the purulent form needs moist heat or a stimulating blister until the abscess can be opened, which is then given an antiseptic treatment. The chronic form is practically incurable.

Inflammation of the Mammary Gland (Mammitis—Mastitis).

What are the causes of mastitis ?

They are, in the vast majority of cases, of an infectious nature, more rarely due to traumatisms and cold.

How may infection reach the udder ?

The infection may be of lymphogenous origin—that is, reach the mammary gland through the lymph vessels; it may be galactogenous, entering through the opening at the teat; or it may be of hematogenous origin, reaching the gland through the general circulation.

Which is the most common way through which the infection enters the udder ?

Mainly through the opening at the end of the teat.

Which bacteria and fungi are of practical interest in mastitis ?

The bacillus of tuberculosis, a number of specific mammitis bacteria, botryomyces, actinomyces.

Which varieties of mammitis are of practical importance ?

Parenchymatous, catarrhal, acute interstitial, chronic interstitial, purulent, gangrenous mammitis.

What are the terminations of mastitis ?

1. Resolution. Between the third and tenth day after the outset of the inflammation of the udder, the more active symptoms disappear, the swelling and pain become less and the nature of the lacteal fluid once more approaches the normal in quantity and quality.

Such prompt resolution is by no means frequent. In cows, at least, mammitis has a chronic tendency. In these cases the

acute inflammatory symptoms recede, but the milk remains changed in composition and quantity and the gland becomes more or less indurated. In these cases complete resolution may take place during the next period of dryness, although this seems impossible on account of the connective tissue proliferation which has occurred.

2. Purulent inflammation. Purulent inflammation and abscess formation may take place in the subcutaneous connective tissue; also in the interglandular, interlobular and interstitial connective tissue; no matter which of these is affected, the glandular tissue proper—that is, the parenchyma—is always involved. Depending on the structures involved, mammitis may be catarrhal (when the mucous lining of the excretory ducts is mainly involved), or there may be a phlegmonous mammitis (when the septic process spreads in the connective tissue framework), etc. Abscesses may be located deeply, and in these cases they usually empty into a lactiferous duct and give the lacteal secretion—that is, the milk—a purulent appearance, at the same time producing a purulent catarrh of the gland and its excretory ducts. But such an abscess may not break but become encapsulated, or the lacteal secretion mixed with pus remains in a lactiferous duct and inspissates; in either instance, hard, rather circumscribed lumps, deeply located in the udder, are felt. Abscesses superficially seated—that is, in the subcutaneous tissue—evacuate into the external world.

3. Atrophy of the glandular substance proper. This is a common termination of mammitis, usually accompanied with induration of the affected parts. In these cases, a chronic inflammation exists, as a result of which the interstitial connective tissue becomes hyperplastic and the glandular tissue proper atrophies. This may occur in a limited area or may

involve a whole quarter. In those cases with decided hyperplasia of the connective tissue, the udder appears enlarged ; in other words, it is an example of pseudo-hypertrophy—atrophy of the glandular tissue proper and hyperplasia of the connective tissue. An udder having undergone pseudo-hypertrophy is vulgarly termed a fleshy udder. Depending on the amount of glandular tissue destroyed, the functional activity of the part involved is either decreased or ceases entirely. In mild infections, the induration—that is, the connective tissue proliferation—may be confined to the lactiferous ducts and reservoir ; in fact, a catarrhal mammitis prevails. In such cases, the lactiferous ducts and sinus have a firm, knotty, pencil-like feel, giving rise to a condition commonly termed hard milkers.

4. Gangrene. Serious circulatory disturbances, the result of an inflammation produced by very virulent infectious material or a diffused purulent state of the connective tissue surrounding the gland, may produce thrombosis of the mammary vessels and thus death of the gland. Sequestration of the necrotic piece, depending on the size, takes place in one to eight weeks. Abscesses form here and there, and through them the gangrenous material is discharged.

What are the complications of mammitis ?

Metastatic arthritis usually of the fetlock and stifle joints, pyemia and septicopyemia.

How does parenchymatous mammitis originate ?

It is either of galactogenous or hematogenous origin.

How does it terminate ?

(1) By resolution. When this fails to take place, by (2) pseudo-hypertrophy or (3) atrophy. When the infection is

sufficiently malignant (4) by abscess formation or even by (5) gangrene.

What are the clinical features of parenchymatous mammitis ?

The inflamed quarter is painful, hot, firm and decidedly swollen. In the earlier stages, the milk is watery, somewhat yellow or even colored red with blood and lumpy ; it contains fibrin.

Which anatomical structures are involved in catarrhal mammitis ?

The mucous membrane of the lactiferous ducts, sinus and teat.

What are sequelæ of catarrhal mammitis ?

As a result of fibrous tissue changes the teat and lactiferous ducts may become obliterated or their lumen becomes much smaller (stenosis); fibrous membranes may develop in the galactopherous sinus, obstructing it, under which circumstances the diseased quarter wastes away. Finally, the catarrhal inflammation may extend to the interstitial connective tissue, producing hyperplasia of the same, as a result of which the diseased quarter becomes indurated and enlarged (pseudo-hypertrophy).

What are the clinical features of catarrhal mammitis ?

In the earlier stages, the gland is not swollen and but slightly painful on deep palpation. The milk is watery and lumpy, resembling whey. Later, as sclerotic changes set in, the teat and sinus feel like a pencil twirled between the fingers, while pseudo-hypertrophy or atrophy are readily recognized, especially when the diseased quarter is compared with healthy ones.

Which structures are involved in acute interstitial mammitis?

This cellulitis, due to infectious agents, attacks the skin, subcutis and interglandular connective tissue.

How does acute interstitial mammitis originate?

It is either the result of an infection from without—that is, by a traumatism—or a symptom of parenchymatous mammitis.

What are the clinical symptoms of acute interstitial mammitis?

The affected quarter is hot, painful, swollen; the parts are firm; fever is present. In the earlier stages, the quality of the milk is unchanged.

What do you understand by chronic interstitial mammitis?

A chronic inflammation of the gland, with connective tissue proliferation and subsequent atrophy of the glandular substance proper. It may either be a sequel to the preceding forms of mammitis, or may represent an idiopathic condition setting in during the period of dryness, as a consequence of which the quarter becomes hard, painless and possibly very much enlarged.

What are the peculiarities of purulent mammitis?

Parenchymatous and catarrhal mammitis, the result of an infection sufficiently severe to entail suppuration, give rise to abscess formation in the glandular tissue. The milk is mixed with pus; fluctuating spots indicate the abscesses; there is high fever.

Under what circumstances is gangrenous mammitis observed?

Parenchymatous mammitis due to an infection with very virulent bacteria, may, in the cow, produce such circulatory

disturbances as to give rise to gangrene of a quarter. In purulent mastitis the same may take place, but the necrotic process is more likely to be circumscribed instead of diffused. In sheep a very fatal gangrenous mammitis is due to the micrococcus mastidis gangrenosæ.

Which clinical features entitle to the diagnosis of tubercular, actinomycotic and botryomycotic mammitis ?

1. Tubercular mammitis : It is either of hematogenous or galactogenous origin ; is a chronic mastitis ; as a rule, the hindquarter is diseased, but the pathological process may by and by involve other quarters. When the hindquarter is tuberculous the supramammary lymph glands are enlarged and hard, the quarter itself shows at first a diffused firm swelling which gets harder and harder, which usually is painless. In this swelling develop presently nodules of variable size, being often of stony hardness ; the glandular tissue adjacent to these nodules atrophies, causing these deeply located nodules to become quite prominent. The quantity and quality of the milk is apparently quite normal for some time (in which respect it differs materially from other chronic forms of mastitis), and for a month looks like healthy milk ; from this time on (exceptions, of course, exist), it becomes watery, until finally it becomes a turbid, yellow, watery fluid containing tubercle bacilli. This condition, after existing two to four months, terminates in death.

2. Actinomycotic mammitis : Seen in the sow and cow. Most likely of galactogenous origin. The actinomycotic process may be localized or may be diffused ; that is, it may be confined to one quarter or involve the whole udder. When only one quarter is diseased, numerous bean to egg sized nodules form in the quarter, which represent as many abscesses

surrounded by dense connective tissue capsules. These break and actinomyces pus is discharged, being a slimy, purulent fluid. In those cases where the whole udder is actinomycotic, the udder, as a whole, becomes indurated, slowly enlarges, showing nodules which eventually break and discharge the pus.

3. Botryomycotic mammitis : This chronic mammitis, in which connective tissue hyperplasia with abscesses and fistulous tracts is observed, is supposed to be due to the entrance of the botryomyces equi either through a cutaneous wound or through the openings at the teat of the mare. At first the symptoms of a parenchymatous mastitis involving one-half of the udder are seen, presently little abscesses form, break and give rise to fistulous tracts, the mouth of which granulates freely ; these may heal and small, puckered-in nodular scars form wherever the fistulous opening was. While this goes on, the udder, as the result of the fibrous tissue proliferation, enlarges and becomes hard ; the soft tissues of the thigh become involved, in cases of long standing, and locomotion is disturbed. Unless this condition is treated properly in time, a cachetic state and death are sure to follow, which, of course, may take years.

Outline the treatment of mammitis.

Decrease the amount of feed and give a saline purgative. In the acute stages, empty the udder often and gently, but do not let the infected milk run upon the floor, but catch it in a vessel so it may be properly destroyed. Before and after each milking the udder ought to be washed with an antiseptic solution. The injection of antiseptic solutions into the milk sinus does not always give good results ; the only safe ones are a 4 per cent. boric acid solution or one containing 1 to 2

per cent. of alum. Moist heat continuously applied is of advantage, especially in the interstitial inflammations of an acute type. In chronic cases, massage is indicated. Liniments and ointments containing camphor, belladonna, turpentine, especially iodine and lard (1:20), are largely employed. Lately the inflation of the udder with sterilized air has been recommended. In the treatment of abscesses the knife is required, with subsequent antiseptic injections. In gangrenous, botryomycotic and actinomycotic mammitis, amputation of a quarter or whole udder may become necessary.

DISEASES OF THE SKIN.

Dermatitis (Inflammation of the Skin).

What are the causes of dermatitis ?

It may be of a specific nature, as glanders or tuberculosis; it may be infectious, as pus-producing bacteria; it may be traumatic, as abrasions, pressure, blows; it may be thermic, as the heat of the sun, fire heat, steam; it may be chemical, as caustics, etc.

How do you classify dermatitis ?

According to its course and extent: acute and chronic, circumscribed and diffused, superficial and deep.

What forms of dermatitis are of practical interest to the surgeon ?

Erythematous dermatitis, suppurative dermatitis, gangrenous dermatitis, chronic hyperplastic dermatitis.

What do you understand by erythema ?

Erythematous dermatitis represents a hyperemic state of the skin, mainly involving the papillary layer.

What changes may take place in the skin in erythema ?

The bloodvessels dilate, the papillary layer swells more or less, there is serous infiltration of the tissues (inflammatory edema). In cases where the hyperemia of the skin persists for some time, desquamation of the epithelium follows. Should the serous inflammation accumulate in the rete mucosum, blisters are formed as the infiltrated serum raises the epidermis from its basis.

In what animals is erythema seen ?

In all animals, but is best observed in those which have a non-pigmented skin. In the horse, seats of predilection are those parts exposed to harness friction and in the flexion surface of the fetlock.

Which are the clinical symptoms of erythema ?

Very slight swelling, pain and arterial redness of the skin; later the hair may drop out and the epidermis scales off. When in the flexion surface of the pasterns, the pain may be sufficient to produce lameness (erythema of the flexion surface of the fetlock represents the mildest form of what is vulgarly termed "scratches").

Outline the treatment of erythema ?

Remove the irritant; mild astringents are indicated.

What is suppurative dermatitis ?

A suppurative inflammation of the skin due to an infection with pus-producing bacteria.

How does suppurative dermatitis occur ?

Either diffused and superficial, when it is termed purulent dermatitis, or circumscribed, when it is known as dermatitis pustulosa; or in those cases where the suppurative process is confined to the hair follicle and its immediate neigh-

borhood it is termed furuncle (boil) ; finally, a carbuncle may be said to be a collection of furuncles.

What is the seat of predilection of furuncles in animals ?

All those parts exposed to mechanical irritations, as in the dog, the neck and nose, and in the horse those regions exposed to harness pressure.

Outline the treatment of furuncles.

In the formative stage, warm, moist fomentations ; later, the abscess is to be opened and the necrotic center, the core, as it is commonly termed, must be removed ; next, disinfection and subsequent antiseptic treatment.

What is gangrenous dermatitis ?

It is an inflammatory condition of the skin, leading to necrosis of the affected skin.

What are the most common causes of gangrenous dermatitis ?

Burns, scalds, caustics, cold, infectious agents.

Where is gangrenous dermatitis often seen ?

As a result of saddle pressure and in the flexion surface of the fetlocks, representing a certain form of eczema (scratches).

What is chronic hyperplastic dermatitis ?

A chronic inflammation of the skin and subcutis characterized by connective tissue proliferation of the skin and subcutis.

Under what other name is chronic hyperplastic dermatitis known ?

Elephantiasis.

What is the etiology of elephantiasis ?

It is the result of chronic inflammatory processes, most

frequently seen in the hindlegs of horses after repeated attacks of cellulitis, lymphangitis, ulcerations; in these cases the acute inflammatory symptoms subside, but infected foci remain in the tissues and lead to chronic irritation, as a result of which an excessive amount of connective tissue is produced, and thus the enlargement of the affected parts.

What is eczema, and to what extent is it of surgical interest?

Eczema is an acute or chronic dermatitis running a typical course, and of surgical interest especially in the horse, where its seat of predilection is the flexion surface of joints, especially the fetlock.

Under what common name is eczematous dermatitis usually known?

Depending upon the part which is affected and stage of the disease, it is known as cracked heels, scratches, grease.

Which varieties of dermatitis are observed in scratches, cracked heels and grease.

1. Dermatitis erythematosus : This is the lightest form of the so-called scratches. When occurring in the non-pigmented skin of the finely bred horse—it being rarely observed in the coarser breeds—the skin is seen to be red, warm, more or less swollen and somewhat painful. Unless the irritant is removed it may develop into the following variety of dermatitis :

2. Dermatitis eczematosa : Probably the first thing which is noticed is that the horse limps a little the first few steps it takes, the hairy skin rendering it difficult or impossible to observe the earlier forms of this dermatitis—namely, the papular (groups of pinhead sized pimples) and vesicular (little blisters) stages—although the latter is more readily noticed than the former. The next form, that of red eczema (stadium madidans), is the one when the surgeon is called in. Here is

found an infiltrated, swollen surface, from which more or less serum exudes, its watery parts evaporate and a crust remains behind. Now the stadium crustosum is reached. On removal of the crust, a raw, red, oozing surface is seen. Proper treatment at this time is followed by loosening of the crusts, the surface desquamates (stadium squamosum) and the destroyed epidermis is replaced. Should the animal not receive the consideration which it should, especially when kept at work, this regular course of healing does not take place and the skin becomes fissured. In these cases chronic connective tissue changes are a sequel, giving rise to the formation of keloids.

3. *Dermatitis gangrenosa* : This variety of dermatitis may arise independently as a spontaneous skin necrosis, or may follow in the wake of a neglected and infected eczematous dermatitis, especially when the skin is fissured and the animal worked in slushy and very cold weather. In gangrenous dermatitis setting in spontaneously, intense and sudden lameness is observed. The animal, most likely, was put away the night before in good health and in the following morning walks upon three legs ; a part of the leg, or the greater portion of it, may be swollen, the diseased skin is soft and has a soapy feel, a reddish liquid oozing from it. In two to five days the necrotic, gray, soft piece of skin becomes loose, the defect being eventually covered with granulations, unless the septic process invaded adjacent structures, as the lateral cartilage, tendon sheath, etc., when symptoms peculiar to these conditions predominate.

4. *Dermatitis chronica verrucosa* : Usually affects the hindlegs of long-haired horses, starting at some place in the region of the fetlock, from where it may spread.

The hair has dropped out, more or less, and the surface is covered with a gray, smeary mass, smelling badly. This

mass consists of epidermal cells macerated by the exudate. In this skin disease there is an active proliferation going on in the papillary and malpighian layer, at the same time involving the cutis and subcutis. The papillæ of the papillary layer enlarge greatly and appear as wart-like excrescences. In the rete mucosum, which, of course, rests right upon these enlarged papillæ, cells are formed so rapidly that they do not have time to become horny, but are continuously soaked and macerated by the inflammatory exudate, so that they appear upon the surface as a gray, smeary mass previously mentioned; should the cell production in the rete mucosum be less rapid, the surface has a gray, dusty appearance. The dropping out of the hair is explained by the fact that the pathological process extends to the hair follicles. As a result of the connective tissue proliferation of the cutis and subcutis in cases of long standing, elephantiasis of the leg is a consequence.

What is the prognosis of dermatitis eczematosa ?

When the horse can be given complete rest recovery takes place in eight to fourteen days. In those cases where the skin is fissured, unfavorable complications may arise; at any rate, the treatment is much more difficult and considerable time and skill are required to prevent the formation of large keloids.

What is the treatment of eczematous dermatitis ?

In the earlier stages, a warm, moist, antiseptic cataplasm is indicated to remove all the crusts. Of the endless number of agents employed in this disease, tannoform or red oxide of mercury ointment (1 : 5) has given me the best results. In the earlier stages, where excessive granulations are to be combated, these may have to be snipped off and a powder of one

part of alum and two of tannoform, held in place by a pressure bandage, is indicated. The average time required to heal this state is about fourteen days.

What is the prognosis of dermatitis gangrenosa ?

This depends entirely on the extent of the lesion and the intensity of the infection. No definite rule can be given.

What is the treatment of gangrenous dermatitis ?

In the beginning, warm antiseptic cataplasm to hasten separation of the necrotic piece. Later the wound is dried off and healed under a scab with tannoform or alum tannoform powder ; the latter is used, provided the granulations are excessive. Complications, as quittor, septic tendovaginitis, etc., have to be treated accordingly. Fröhner reports good results by treating these cases with tincture of iodine.

What is the prognosis of dermatitis chronica verrucosa ?

Weeks and months are often required to produce a cure. The greater the proliferations of the papillary layer of the skin—that is, the larger the wart-like excrescences—the more difficult the treatment. In those cases where the skin is wrinkled, and the warts large, a cure is excluded.

What is the treatment of chronic verrucous dermatitis ?

Should the parts be covered with crust and the whole region edematous, apply a warm antiseptic cataplasm for twenty-four hours, wash the parts perfectly clean and dry them ; now apply with a brush three times daily sulphuric acid one part, alcohol twenty parts. For cases which ooze very persistently, a dressing moistened with the above liquid may be applied. After the parts dry off, use daily red oxide of mercury one part, lard five parts. There are ever so many other remedies, but none as reliable as the above line of treatment suggested.

Burns and Scalds.

What is a burn ?

The destruction of the skin and underlying tissues due to an exposure to excessive temperatures.

What are the causes of burns and scalds ?

Fire, caustics, steam, hot water, etc.

Under what circumstances are burns of therapeutic value ?

When employed as the actual cautery, also when chemicals are used as rubefacients, vesicants and escharotics.

What points does the surgeon take into consideration in burns ?

The intensity and the extent of the burn.

Depending on the intensity of a burn, which three degrees are of practical value ?

First degree : An excessive temperature acts but momentarily, followed by dilatation of the bloodvessels, especially the arteries ; consequently the skin not provided with pigment appears bright red (erythema) ; at the same time there is more or less pain and some swelling due to serous infiltration of the skin. These symptoms disappear in a few hours, but are followed by desquamation of the epidermis.

Second degree : An excessive temperature acts a little longer than in the first degree. As the result of this a serous exudate accumulates under the horny layer of the skin, raising it ; in other words, producing larger and smaller blisters. These blisters are not very well seen in animals with a hairy coat, as the hair, being firmly fixed in the cutis, holds the epidermis down. The swelling and pain are considerable. The pain disappears in about twelve to twenty-four hours,

while the swelling may persist for several days. The contents of the blisters are absorbed and the blister, unless opened, dries up in a few days. A new horny layer is formed and the old one thrown off. In those cases where the blister is opened, nine to fourteen days pass before a new epidermis is reproduced.

3. Third degree: An excessive temperature acted for some time. Here carbonization of the tissues occurs. Under pus formation the necrotic tissues are loosened and thrown off, after which granulations spring up and finally a scar leading to more or less deformity forms.

What points are to be considered in the prognosis of a burn?

Primarily the extent and next the intensity of the burn.

How much of the body surface must be burned to entitle to a doubtful or unfavorable prognosis?

It seems that in the horse when one-fifth to one-tenth of the body surface is destroyed, a fatal termination is imminent.

What constitutional symptoms do extensive burns produce?

Dogs are very much excited; later distinct collapse with dyspnoea and subnormal temperature follows; in other instances, there are convulsions. In horses, after extensive burns, especially when the mucous membrane of the respiratory tract is injured by the inhalation of hot and acrid vapors, a fatal hemoglobinuria finishes the creature.

How is the appearance of hemoglobinuria after extensive burns explained?

As a result of the action of the heat upon the skin capillaries, the blood disintegrates and hemoglobinuria is created at once. The hemoglobin which now circulates in the blood current causes hemoglobinuria.

How is sudden death after burns explained?

The most generally accepted theory is that the death from burns is the result of poisoning, the poison being a chemical. It has also been pointed out that the white blood cells, by the action of the heat, disintegrate, and that as a result of this certain toxic agents are formed which cause necrosis of the internal organs by coagulating the blood in the capillaries of such organs. Furthermore, certain chemicals, as ammonia, prussic acid, etc., are supposed to form.

In which respect do scalds differ from burns?

There is very little difference. From the standpoint of intensity, the same three degrees as given under burns are considered. Right here it may be stated that cutaneous injuries following the actions of strong alkalies and acids are more closely related to a burn than a scald.

Outline the treatment of burns and scalds.

Burns of the first degree are rarely treated by the veterinarian. In those of the second degree the blisters are opened at the most dependent part under antiseptic precautions; parts which can be bandaged are then dressed with aristol, boric acid, zinc oxide 1 : 2, or when bandages cannot be applied frequently painted with Carron oil (lime water and linseed oil aa). Burns of the third degree require unirritative germicidal lotions. Sloughs are removed and trimmed away wherever possible. As soon as the parts begin to granulate, astringent and antiseptic powders, as tannoform, are indicated. In those cases where such extremities as the tail and ears are burned beyond the possibility of recovery, they are to be amputated. Burns the result of alkalies are neutralized by dilute acids—for instance, vinegar; while those due to acids are treated with alkalies—as soap water, for instance—

after which they are treated as other burns. Internally, stimulants are of value.

How do you treat burns due to lightning and strong electric currents?

The treatment of wounds due to lightning and strong currents, as they are occasionally seen in the larger cities when the overhead wires of an electric car system break, are treated in the same way as other burns. The paralyses following these electric strokes usually terminate favorably.

Frost Bite (Congelatio).

Is the detrimental action of excessive cold in animals common?

It is not. Freezing to death, on the whole, is rare; partial freezing is quite frequent, especially those parts devoid of a well-developed, hairy dress, as the scrotum in bulls and the coronary region and hollow of the heel in horses' ears and tails of pigs.

How does the hairy coat of animals protect against frost bites?

Dry hair folded against the body surface is a poor conductor of heat; at the same time, between the hair and the skin air spaces are formed which prevent the radiation of the body heat. All this is changed as soon as the hair becomes wet from slush or snow. At this moment the air spaces formed by the dry air are done away with and the radiation of the body heat is no longer prevented, but rather encouraged. Consequently the vitality of such a part is lowered and the whole body temperature lowered. Nevertheless, the lay of the hair and the greasy state of the skin—made so by the product of the sebaceous glands—strongly protect the

skin against an ordinary wetting, and the prolonged action of moisture is necessary to soak the cutaneous covering. It is for this reason that the lower extremities, continuously exposed to moisture, as the coronary region and heels of the horse's hoof, more easily succumb to the action of excessive cold. Another reason, and a potent one, why the lower extremities exhibit frost bites, more commonly lies in the fact that wounds of more or less consequence are often met with in those localities. The cold lowers the vitality of the parts, purulent bacteria always abound, they enter the wounds, multiply and are followed by more or less extensive necrosis of the parts invaded by them. I really think that the vast majority of so-called frost bites of the lower extremities in the horse are no frost bites at all, but septic infections made possible by the lowered vitality of the tissues due to the exposure to prolonged and excessive cold, which, when active as moisture, macerates the epidermis, thus predisposing to infections.

How does excessive cold affect the skin ?

Three degrees of freezing are recognized.

What are the peculiarities of these three degrees ?

First degree : Due to moderate cold acting temporarily. The changes occurring in pigmented skin are either not to be seen or are ill defined. The changes which take place are : As the result of the action of the cold anemia of the skin sets in as the arteries contract. Next the arteries dilate and the venous circulation becomes gorged, for which reason the skin appears dark red ; at the same time more or less swelling and pain are present.

Second degree : Due to a more persistent action of cold. Here the same changes as above occur, only the exudation under the epidermal layer is excessive, and consequently

large and small blisters form ; contrary to burns, there is more tendency to necrosis of the frozen parts.

Third degree : Due to the persistent action of excessive cold. The fluids in the skin either congeal or the circulatory disturbances, viz.: venous stasis, lead to necrosis of the exposed part, and since the skin is usually overfilled with blood that form of necrosis known as moist gangrene is mostly observed. Suppurative separation of the gangrenous tissue takes place, followed by granulations and finally cicatrization.

How do you treat congelations ?

The veterinarian is not often called to treat those of the first degree, should it be the case through friction with snow and ice, until the temperature of the part is about normal, when friction with spirits of camphor and next a dry cotton dressing are indicated. The main point in such cases is to gradually bring about a return of the heat-producing power of the affected part. Freezing of the second and third degree is treated in the same manner as burns of that class.

What prophylactic means can be employed to prevent freezing of the lower extremities of the horse ?

The loss in time and money to horse owners from gangrenous dermatitis either due to partial freezing or infection, or most likely to a combination of these two factors soon after slushy weather sets in, is material. I have for a number of years received excellent results by ordering the hollow of the heel and the coronary region painted with carbolized neats foot oil (carbolic acid 1, neats foot oil 32 parts). This is applied every morning as long as the ground is slushy. In the evening it is washed off and the parts dried by rubbing them with wood shavings, which are used here generally for bedding. While incurring some extra work on the part of

the teamster, the good results following this practice warrant it, which of course is the decisive feature.

Inflammation of the Podophyllous Membrane (Pododermatitis).

What anatomo-physiological facts are of interest in the surgical diseases of the pododerm?

This subject has been exhaustively dealt with in my work on "The Clinical Diagnosis of Lameness of the Horse." The reader therefore is referred to it for details.

Generally speaking, the pododerm is related in its make-up to the skin; in fact, it is a continuation of the external cutaneous covering, the former not producing any hair or epidermis, but horn instead. The rete malpighi, which covers the cutis proper, is strongly developed. The papillary body of the cutis is exceedingly prominent, large papillæ stud the sole and frog and especially the coronary cushion. In the region corresponding to the wall of the hoof the papillary layer is enormously developed, represented by the primary and secondary laminae, which again are protected by a strong rete malpighi. Composed of many vessels resting in loose connective tissue, the vascular layer is next to the papillary body; the deepest layer ensheaths the os pedis, representing the periosteum. The subcutis, the basis for all these layers, is irregularly distributed. It is only found underneath the coronary cushion, sensitive laminae of sole and wall (excepting over the os pedis), fibro-cartilages, tendon of the extensor pedis, and finally, although materially modified in shape, of the plantar cushion.

What varieties of pododermatitis interest the surgeon?

The inflammatory processes may be acute and chronic,

circumscribed and diffused, superficial and deep; or parenchymatous, they may be aseptic or septic, serous, hemorrhagic, purulent, phlegmonous and gangrenous.

What every-day term is applied to hemorrhagic pododermatitis?

Corns.

What is diffused, superficial, aseptic pododermatitis termed?

Founder, laminitis.

Give an example of chronic productive pododermatitis.

Keraphyllocele, also termed keratoma.

What regions of the pododerm only can undergo phlegmonous inflammation?

Only those which are endowed with a layer of connective tissue. Septic cellulitis therefore develops: underneath the coronary cushion, termed subcoronary cellulitis; adjacent to the lateral cartilage, termed parachondreal cellulitis (which process initiates all quittors); and finally, in the connective tissue of the plantar cushion (fibro-fatty frog).

DISEASES OF MUCOUS MEMBRANES.

The diseases of which mucous membranes are of surgical interest?

Inflammation of the mucosa of the eye (conjunctivitis); that of the nasal canal (rhinitis); that of the buccal cavity (stomatitis); that of the pharynx (pharyngitis); that of the rectum (proctitis); that of the vagina (vaginitis); that of the uterus (endometritis); that of the bladder (cystitis).

What are the causes of inflammation of the mucous membranes?

In regard to the etiology and varieties of the inflammatory processes of the mucous membranes the same points hold good which have been considered under "Inflammation of the Skin."

How do you treat the surgical diseases of the mucous membranes?

The treatment may be an operative one or the application of antiseptics and astringents is indicated.

DISEASES OF THE SUBCUTIS.

Edema.

What is edema?

A dropsy or serous infiltration of the subcutaneous connective tissue.

What varieties of edema are of surgical interest?

Inflammatory edema, passive or stasis edema.

What is an inflammatory edema?

A serous inflammation of the cutis and subcutis due to infectious, toxic, thermic or traumatic agents. In other words, an infectious, thermic, traumatic or toxic agent produces an inflammation of the cutis and subcutis; as a result of this inflammation a serous exudate forms; this exudate infiltrates the lymph spaces of the cutis and subcutis and the condition known as inflammatory edema is present.

What is collateral edema?

An inflammatory edema of any cutis and subcutis imme-

diately surrounding a suppurative focus (for instance, an abscess).

What are the symptoms of inflammatory edema?

The diseased section is swollen, its overlying cutaneous covering is tense, hot and painful.

What is a stasis edema?

A dropsical state of the lymph spaces of the cutis and subcutis due to an obstruction of the venous or lymphatic circulation.

How is stasis edema explained?

The return flow of the blood may be variously interfered with. Lowered vitality due to debilitating diseases, old age, weak heart, want of exercise, chronic heart, lung, kidney, liver and blood diseases all have a tendency to produce certain changes in the endothelial lining of the walls of the blood vessels, as a result of which liquid and corpuscular elements can leak from the vessel holding them. Pathologists generally agree that injury to the endothelial cells and cement substance between these cells are the most important factors in allowing a transudation to take place—supported, of course, by intravascular pressure and anything interfering with the free flow of the blood. An obstruction to the lymphatic circulation in itself rarely produces a stasis edema, because lymph vessels anastomose too freely, but they assist in the production of passive edema whenever the demands made upon them are greater than their capacity for work; in other words, the lymph spaces, instead of being continuously and regularly emptied, remain filled with the transudate.

What are common examples of stasis edema in animals?

In the horse, stocking of the hindlegs, even of the sheath,

is common. In the pregnant mare and cow, stasis edema of the udder, hindlegs and along the belly is often observed.

What are the symptoms of stasis edema ?

In non-pigmented skins, a soft to doughy swelling, which may or may not pit on pressure, of bluish color, painless and cool, characterizes this variety of edema.

How do you treat edema ?

The treatment of inflammatory edema is an antiphlogistic one, therefore hydropathic means, antiseptis, and incisions to rid the tissues of septic material are necessary.

The treatment of stasis edema depends, necessarily, on the cause of this condition; externally, hand rubbing, bandaging, slight vesication, scarifications; internally, tonics, diuretics, purgatives, etc., are indicated.

Emphysema.

What is subcutaneous emphysema ?

An accumulation of air in the meshes of the subcutaneous tissue.

How does subcutaneous emphysema arise ?

1. By traumatism.
2. By septic processes.

Explain traumatic emphysema.

Air may enter through any cutaneous wound and infiltrate the subcutaneous tissue; wounds about the neck, elbow and thorax especially predispose to emphysema, as the movements of these parts produce a sucking and pumping action—that is, the air is, so to speak, sucked through the skin wound into the subcutaneous tissues, and from here it is pumped up further into the tissue by the compressing action of the cutaneous cover. But air may also be forced into the subcutane-

ous tissue from within—that is, following injuries to the parenchyma of the lung, perforation of the esophagus, rupture of the rectum. When air or gases accumulate in the cavities of the body, as the thorax (by perforating chest wounds), it is termed pneumothorax; or, when accumulating in the rumen of a cow, stomach or intestines of other animals, it is termed tympanitis and of surgical interest, as the trocar and canula may be called into play to relieve the bloated state.

What are the symptoms of emphysema?

A more or less diffused swelling, painless, of normal temperature, producing a fine, crackling sensation when stroked with the hand, and tympanitic on percussion.

What is the prognosis of subcutaneous emphysema?

Favorable, unless it is a symptom of serious destruction of vital tissues.

What becomes of the air in the subcutaneous tissue?

It is gradually absorbed by the lymph and blood vessels.

What is septic emphysema?

The accumulation of putrefactive gases, the product of gas-producing bacteria, in the subcutis.

What is the etiology of septic emphysema?

Bacteria capable of manufacturing putrefactive gases invade the subcutaneous tissue. There is therefore a marked difference between traumatic emphysema, where air pure and simple is contained in the tissues, and septic emphysema, where the tissues contain gases of putrefaction, as hydrogen, sulphuretted hydrogen, carbonic acid, etc.

What are the symptoms of septic emphysema?

The presence of these putrefactive micro-organisms not

only is followed by gas formation, but also by a train of symptoms suggestive of an inflammatory process of the skin and subcutaneous tissue. In other words, the characteristics of a septic cellulitis plus gas formation are present.

How do you treat emphysema ?

Compression and multiple punctures may be employed, but usually no treatment at all is necessary, provided, of course, the original cause of the emphysematous state is not a fractured rib, ruptured rectum, esophagus, etc.

The treatment of septic emphysema must be an active one : deep and long incisions, with antiseptic treatment, and, if conditions warrant it, amputation of the septic member.

CONGENITAL MALFORMATIONS.

What congenital malformations are of practical surgical interest ?

Genital Apparatus.

MALES.

What is a cryptorchid ?

An animal the testicles of which are not in the scrotum.

What is a monorchid ?

An animal having only one testicle in the scrotum.

Where are the undescended testicles ?

Either in the abdomen or in the inguinal canal.

What is phimosis ?

Stenosis of the prepuce, rendering it difficult or impossible to uncover the glans penis.

What is understood by persistence of the urachus in colts and calves ?

At the time of birth the fundus of the bladder closes as the navel string tears. Should this physiological process be disturbed, the urine drips from the umbilical opening.

What is the prognosis ?

Favorable.

What is the treatment ?

Cauterization of the opening or closing it with a purse suture.

FEMALES.

Closure of the Vagina.—This condition, termed *atresia vaginæ*, when existing, is usually accompanied by an absence or imperfect development of the uterus. The hymen may be excessively developed and interfere with coitus.

Digestive Apparatus.

What is a hare-lip ?

A gap in the continuity of the lip, being of foetal origin.

What is a cleft palate ?

A fissured state of the palate, being of foetal origin.

How is a hare-lip and cleft palate formed ?

The study of the development of the foetus teaches that by the coalescence of various clefts, fissures peculiar to foetal life are effaced. But when this union fails to take place, or becomes imperfect, certain deformities, as the hare-lip or cleft palate, remain.

In what animals are the hare-lip and cleft palate seen ?

Occasionally in the puppy and colt.

Teeth.

What congenital malformations of the jaws and teeth are of interest to the surgeon?

Quite common are supernumerary teeth, also tusks in canines and mares. By *prognathia superior* is understood an upper jaw which exceeds in length the lower jaw, commonly known as an overshot jaw; by *brachygnathia inferior* is understood a lower jaw which is too short. The opposite condition—that is, an undershot jaw—simply reverses matters.

Intestines.

In what animals are congenital malformations of the intestine observed?

In pigs, colts, puppies, in the shape of a hernia; another malformation, which is by no means rare, is partial or complete obliteration of the anus and rectum, known as *atresia ani* and *atresia recti* respectively.

Eye.

What are dermoid tumors?

Small, skin-like, hairy growths at the margin of the cornea, most frequently seen in dogs and calves, but occasionally also in other animals.

What other congenital malformations are observed?

Paralysis of the optic nerve ending, known as *amaurosis*, *cataracts*; in horses, excessive development of the soot balls, congenital fissure of the iris, termed *coloboma*, closure of the inferior opening of the lachrymal canal; in puppies, congenital closure of the palpebral fissure; in dogs and colts, congenital atrophy of the eye, known as *microphthalmus*.

Mammary Gland.

What congenital malformations of the udder are of practical surgical interest ?

In cows, closure of the teat opening, congenital atrophy of one quarter of the udder. Occasionally the mammary gland is entirely wanting. In males, especially the he-goat, an excessive development of the mammary gland is sometimes observed.

Skin.

What congenital malformations of the skin interest the surgeon ?

Excessive growth of hair, known as *hypertrichosis*, is seen upon the manes and tails of horses ; a congenital baldness (*alopecia*) in bovines, goats and horses. In dogs the claws are of interest ; they may be variously curved, termed *onychogryphosis*, or are imbedded in the skin on the style of the ingrown toe nail of man, which condition is called *paronchia*; or they develop to excess, which is termed *hyper-onchia*.

Bony Skeleton.

What congenital defects of the bony skeleton interest the surgeon ?

In the pig especially, and occasionally in the horse, supernumerary phalanges are seen, a condition termed *polydactylism*. In the pig, the coalescence of both claws into one is not uncommon and is called *syndactylism*. Sometimes one or more toes are wanting (*perodactylism*).

Respiratory Apparatus.

What congenital malformations of the respiratory apparatus are of practical interest?

In puppies, congenital struma is common. The trachea may be twisted, excessively dilated or its lumen may be stenosed. In colts, nasal dyspnoea and catarrhal symptoms follow an abnormal development of the turbinated bones.

Ear.

What congenital malformations of the ear are of surgical interest?

In Maltese cats, congenital deafness is quite common.



INDEX

| A | | PAGE | | PAGE |
|----------------------------------|-----|-------------------------------|----------|------|
| Abdominal hernia | 50 | Adenomata | 117 | |
| — wounds | 2 | Alveolar sarcoma | 105 | |
| Abnormal granulations..... | 17 | Amyelinic nerve fibres..... | 100 | |
| Abscess..... | 69 | Anchylolysis | 164, 213 | |
| — acute..... | 70 | Angeioma..... | 102 | |
| — cold | 70 | Angiosarcoma | 105 | |
| — circumscribed..... | 70 | Anemia | 4 | |
| — deep | 71 | Aneurism | 264 | |
| — diffused | 70 | — aortic | 265 | |
| — formation of | 69 | — cirroid .. | 264 | |
| — gravitative..... | 70 | — false..... | 264 | |
| — intermuscular | 71 | — sacculated | 264 | |
| — metastatic | 70 | — treatment of..... | 267 | |
| — superficial | 71 | — tubular..... | 264 | |
| — symptoms of | 71 | Aneurismal varix..... | 265 | |
| — subcutaneous | 71 | Anthrax..... | 21, 30 | |
| — subperiosteal..... | 181 | Antiseptic drugs..... | 41 | |
| — treatment of | 72 | Aortic aneurisms..... | 265 | |
| — tympanitic..... | 70 | Aponeuroses, diseases of..... | 251 | |
| Acinous carcinoma..... | 114 | — necrosis of | 251 | |
| Actinomyces fungus | 121 | — rupture of | 253 | |
| Actinomycomata..... | 121 | Arrest of hemorrhage..... | 7 | |
| Actinomycolysis | 21 | Arterial hemorrhage | 2 | |
| Actinomycolysis of the mammary | | Arteries, diseases of.... | 262 | |
| gland..... | 123 | Arteries, rupture of | 268 | |
| — of the muscles..... | 124 | Arteritis..... | 262 | |
| — of the skin..... | 123 | Arthritis, acute..... | 195 | |
| — of the subcutis..... | 123 | — aseptic..... | 195 | |
| — of the tongue..... | 124 | — chronic..... | 195 | |
| Actinomycolytic mammitis | 284 | — deforming..... | 199 | |
| — lymph glands.... | 123 | — fibrinous..... | 201 | |
| Actual cautery as a hemostatic.. | 11 | — fungous..... | 202 | |
| Acute arthritis..... | 195 | — gouty | 204 | |
| — abscess..... | 70 | — panneous | 201 | |
| | | — purulent | 198 | |
| | | — pyemic | 203 | |

| | PAGE | | PAGE |
|----------------------------------|----------|--------------------------------------|--------|
| Arthritis, septic | 195, 203 | Callus, permanent | 163 |
| — specific | 196 | — provisional | 163 |
| — traumatic | 195 | Cancer, encephaloid | 108 |
| Arthrogenous contracture | 215 | — scirrhus | 108 |
| Articular contracture | 215 | Cancerous cachexia | 108 |
| — contusions | 213 | Capillary hemorrhage | 3 |
| — rheumatism | 202 | Carcinoma of the mucous mem- | |
| Articulations, diseases of | 195 | brane | 113 |
| Aseptic arthritis | 195 | — of the skin | 113 |
| — wound fever | 4 | Caries | 186 |
| Atheromatous cyst | 120 | — dental | 187 |
| Atrophy, degenerative | 249 | — necrotic | 187 |
| Atrophy of bone | 189 | Caro luxurians | 17 |
| — of muscles | 248 | Cartilage wounds | 20 |
| B | | Cartilaginous tumor | 98 |
| Bandages | 41 | Cataplasms | 64 |
| Benignant tumors | 86 | Catarrhal mammitis | 282 |
| Blackleg | 30 | Causes of inflammation | 56 |
| Blind fistula | 77 | Cellulitis | 21, 23 |
| Blood, regeneration of | 8 | — circumscribed | 25 |
| Bone necrosis | 189 | — diffused | 26 |
| Bones, diseases of | 151 | — gaseous | 24 |
| Bony wounds | 2 | — septic | 26 |
| Botryomycoma | 91, 125 | — specific | 24 |
| — of the mammary gland | 127 | — suppurative | 23 |
| — of the muscles | 127 | Cerebral paralysis | 257 |
| — of the spermatic cord | 126 | Cervical wounds | 2 |
| Botryomycosis | 21 | Changes of bandages | 42 |
| Botryomycotic mammitis | 285 | Check of hemorrhage | 10 |
| Burns and scalds | 293-296 | Chondroma | 98 |
| Bursitis | 236 | Chronic arthritis | 195 |
| — purulent | 237 | — endurance | 27 |
| C | | Cicatricial contracture | 216 |
| Calculi, intestinal | 133 | Cicatrization | 14 |
| — lacteal | 134 | Circumscribed abscess | 70 |
| — preputial | 134 | — cellulitis | 25 |
| — renal | 132 | Cirroid aneurism | 264 |
| — salivary | 134 | Classification of wounds | 1 |
| — treatment of | 135 | Cleft palate | 306 |
| — urinary | 133 | Clinical examination of tumors | 88 |
| Callus, ossification of | 165 | Closure of the vagina | 306 |
| | | Coagulation necrosis | 18 |
| | | Coenurus cerebialis | 140 |
| | | Cohnheim's inclusion theory | 113 |

| | PAGE |
|------------------------------------|----------|
| Cold abscess | 70 |
| Cold and heat as hemostatics.... | 11 |
| Cold fomentations | 63 |
| Collateral edema..... | 301 |
| Comminuted fracture..... | 154 |
| Complete fistula..... | 78 |
| Compound fibroma..... | 91 |
| — fracture | 154 |
| Concretions | 132 |
| Condyloma | 115 |
| Congelatio..... | 296 |
| Congenital contracture..... | 217 |
| — cyst | 120 |
| — fistula | 78 |
| — malformations | 305-309 |
| Connective tissue tumors..... | 87, 90 |
| Constituents of pus..... | 22 |
| Constitutional effects of gangrene | 84 |
| Continuous irrigation | 63 |
| Contracture, arthrogenous | 215 |
| — articular | 215 |
| — cicatricial..... | 216 |
| — congenital | 217 |
| — myogenous..... | 216 |
| — neurogenous..... | 216 |
| — tendogenous | 215 |
| Contused articulations | 213 |
| — wounds | 6 |
| Contusions..... | 47, 212 |
| — causes of..... | 47 |
| — definition of | 47 |
| — degrees recognized | 47 |
| — differential diagnosis..... | 50 |
| — microscopical changes in..... | 48 |
| — of practical interest..... | 51 |
| — process of resorption of..... | 48 |
| — — of organization of | 48 |
| — — of necrosis | 49 |
| — symptoms of | 49 |
| — termination of | 48 |
| — treatment of | 50 |
| Corneal wounds | 2 |
| Corns..... | 300 |
| Corpora libra..... | 134, 217 |

| | PAGE |
|-----------------------------|------|
| Cryptorchids | 305 |
| Cysticercus cellulosæ | 140 |
| Cystomata..... | 120 |
| Cyst, atheromatous..... | 120 |
| — congenital..... | 120 |
| — degeneration | 119 |
| — dermoid..... | 120 |
| — extravasation | 119 |
| — exudation | 119 |
| — retention..... | 120 |

D

| | |
|------------------------------------|---------|
| Deforming arthritis | 199 |
| Degeneration, reaction of | 256 |
| Degeneration cyst..... | 119 |
| Degenerative atrophy..... | 249 |
| Dental caries..... | 187 |
| — osteoma..... | 99 |
| Depression fracture | 153 |
| Dermatitis..... | 286-292 |
| — eczematosa..... | 289 |
| — erythematosa | 289 |
| — gangrenosa | 290 |
| — suppurative..... | 287 |
| Dermoid cyst | 120 |
| — tumors..... | 307 |
| Description of wounds..... | 4 |
| Diagnosis of cerebral paralysis .. | 257 |
| Diffused abscess..... | 70 |
| — cellulitis | 26 |
| Diphtheritic inflammation | 58 |
| Diseases of aponeuroses | 251 |
| — of arteries | 262 |
| — of articulations..... | 195 |
| — of bones | 151 |
| — of glands..... | 276 |
| — of lymph vessels | 273 |
| — of mucous membranes..... | 300 |
| — of nerves..... | 254 |
| — of the skin..... | 286 |
| — of the subcutis | 301 |
| — of veins..... | 270 |
| Dislocations..... | 206 |
| Dissecting aneurism..... | 265 |

| | PAGE | | PAGE |
|----------------------------------|---------|-------------------------------------|----------|
| Distortion..... | 209 | Fibrinous arthritis..... | 201 |
| Disturbed function..... | 3 | — inflammation..... | 57 |
| Drainage..... | 43 | Fibroma..... | 90 |
| Dressings..... | 41 | — compound..... | 91 |
| Dropsy of tendon sheaths..... | 232 | — durum..... | 90 |
| Dropsy of the mucous bursa..... | 238 | — hard..... | 90 |
| Drugs, antiseptic..... | 41 | — molle..... | 90 |
| Dry gangrene..... | 81 | — seats of predilection of..... | 92 |
| | | — soft..... | 90 |
| E | | Fibrous callus..... | 164 |
| Eczema..... | 289 | — tumor..... | 90 |
| Edema..... | 301 | Filaria papillosa..... | 140 |
| Electrical properties of muscles | | Fissure fracture..... | 153 |
| and nerves..... | 256 | Fistula..... | 77 |
| Elephantiasis..... | 94, 288 | — action and results of in the | |
| Emphysema..... | 303 | skin and underlying parts..... | 138 |
| — septic..... | 304 | — blind..... | 77 |
| Emphysematous gangrene..... | 81 | — classes recognized..... | 77 |
| Empyema..... | 58 | — congenital..... | 78 |
| Encephaloid cancer..... | 108 | — description of..... | 77 |
| Endocarditis..... | 202 | — operations for..... | 80 |
| Endothelioma..... | 105 | — purulent..... | 78 |
| Enduration, chronic..... | 27 | — secretory..... | 80 |
| Epiblastic tumors..... | 108 | — symptoms of..... | 78 |
| Epithelial neoformations..... | 108 | — treatment of..... | 79 |
| — tumors..... | 87 | — varieties of..... | 77 |
| Erethistic granulations..... | 18 | Foreign bodies..... | 135 |
| Erythema..... | 286 | — definition of..... | 135 |
| Etiology of lipomata..... | 96 | — effect upon cattle..... | 137 |
| — of tumors..... | 87 | — in the eye and ear..... | 138 |
| Excretory fistula..... | 80 | — in the mouth..... | 135 |
| Exfoliation..... | 189 | — in the pharynx and esophagus..... | 136 |
| Exostosis..... | 99, 190 | — in the stomach of cattle..... | 136 |
| Extravasation cyst..... | 119 | — in the stomach and intestines | |
| Exuberant granulations..... | 18 | of dogs..... | 137 |
| Exudation cyst..... | 119 | — in the rectum and urethra..... | 137 |
| | | — in the respiratory apparatus..... | 137 |
| F | | — of surgical interest..... | 135, 140 |
| Facial paralysis..... | 259 | — treatment for..... | 139 |
| False aneurism..... | 264 | Founder..... | 300 |
| — neuroma..... | 100 | Fractures..... | 151 |
| Fatty tumor..... | 95 | — animals most subject to..... | 155 |
| Fever, septic..... | 4 | — causes of..... | 151 |
| — traumatic..... | 4, 21 | — classification of..... | 152 |

| | PAGE |
|-----------------------------|---------------|
| Fractures, comminuted | 154 |
| — compound | 154 |
| — definition of | 151 |
| — dentated..... | 154 |
| — diagnosis of..... | 154 |
| — healing of..... | 163, 166, 179 |
| — in the dog | 176 |
| — in the horse | 173 |
| — longitudinal | 154 |
| — multiple | 154 |
| — oblique | 154 |
| — prognosis of..... | 159 |
| — reduction of | 167 |
| — transverse | 154 |
| — treatment of | 166, 168, 172 |
| — T-shaped..... | 154 |
| — V-shaped | 154 |
| Frost-bite..... | 296 |
| Fungous arthritis..... | 202 |
| — ulcer | 75, 77 |
| Furuncles..... | 288 |

G

| | |
|-----------------------------------|--------|
| Galls | 232 |
| Gangrene..... | 81 |
| — causes of..... | 82 |
| — classification of | 81 |
| — constitutional effects of | 84 |
| — definition of | 81 |
| — dry | 81 |
| — emphysematous..... | 81 |
| — ichorous | 81 |
| — moist | 81 |
| — phagedenic | 81 |
| — putrid | 81 |
| — treatment of..... | 85 |
| Gangrenous inflammation..... | 58 |
| — mammitis..... | 283 |
| Gaping of wounds..... | 3 |
| Gaseous cellulitis | 24 |
| General surgery..... | 1 |
| Giant-celled sarcoma..... | 105 |
| Glanders..... | 21, 38 |

| | PAGE |
|------------------------------|------|
| Glands, diseases of..... | 276 |
| Glandular tumors..... | 117 |
| Granulations, abnormal | 17 |
| — erehistic | 18 |
| — exuberant | 18 |
| Gravitative abscess..... | 70 |
| Green stick fracture..... | 153 |
| Gouty arthritis..... | 204 |
| Gunshot wounds..... | 6 |

H

| | |
|----------------------------------|----------|
| Hard fibroma..... | 90 |
| Hare-lip..... | 306 |
| Healing of fractures | 163, 166 |
| — of non-vascular tissues | 20 |
| — of wounds..... | 13-17 |
| Hematoma..... | 50 |
| Hemiplegia | 254 |
| Hemophilia | 12 |
| Hemorrhage..... | 2 |
| — arrest of | 7, 10 |
| — arterial | 2 |
| — capillary | 3 |
| — check of | 10 |
| — constitutional treatment of .. | 12 |
| — parenchymatous | 3 |
| — regeneration of blood after... | 8 |
| Hemorrhagic inflammation..... | 58 |
| Hernia..... | 141 |
| — abdominal | 50 |
| — definition of..... | 141 |
| — incarcerated | 143 |
| — inguinal | 147 |
| — make-up of a..... | 141 |
| — muscular | 141 |
| — of the brain..... | 141 |
| — pelvic | 146 |
| — reducible | 142 |
| — strangulated..... | 143 |
| — treatment of..... | 144 |
| — umbilical | 146 |
| — varieties of. | 141, 146 |
| — ventral | 146 |

| | PAGE | | PAGE |
|---------------------------------|--------|---------------------------------|------------|
| Hygroma..... | 238 | Intestinal wounds..... | 2 |
| Hyperostosis..... | 190 | Intoxication, septic..... | 30 |
| Hypertrophy of bone..... | 190 | Invagination..... | 148 |
| Hypoblastic tumors..... | 108 | Inversion..... | 148 |
| I | | K | |
| Ichorous gangrene..... | 81 | Keloids..... | 18, 91 |
| — pus..... | 22 | Keraphyllocele..... | 300 |
| Immersion..... | 63 | Kryptogenetic septicemia..... | 30 |
| Impaction displacement..... | 155 | L | |
| Impaired function..... | 60 | Lacerated wounds..... | 5 |
| Incarcerated hernia..... | 143 | Lacteal calculi..... | 134 |
| Incised wounds..... | 5 | Laminitis..... | 300 |
| Incomplete fracture..... | 153 | Leontiasis ossea..... | 191 |
| Infection, parasitic..... | 112 | Ligation of blood vessels..... | 10 |
| Infectious arthritis..... | 195 | Ligatures..... | 41 |
| — cellulitis..... | 23 | Lipoma..... | 95 |
| — diseases, traumatic..... | 21, 34 | Lipomata, etiology of..... | 96 |
| — neoformations..... | 121 | Lipomatous atrophy..... | 250 |
| Inflammation..... | 55 | Liquor puris..... | 22 |
| — abscess..... | 58 | Loose bodies in the joint..... | 217 |
| — causes of..... | 56 | Luxation of a joint..... | 205 |
| — diphtheritic..... | 58 | Lymphadenitis..... | 276 |
| — fibrinous..... | 57 | — parenchymatous..... | 277 |
| — gangrenous..... | 58 | — purulent..... | 278 |
| — hemorrhagic..... | 58 | — specific..... | 277 |
| — of bone..... | 178 | Lymphangiectasis..... | 276 |
| — of mammary gland..... | 279 | Lymphangitis..... | 273 |
| — of osseous tissue..... | 182 | — specific..... | 274 |
| — of veins..... | 270 | Lymphatic gland tumor..... | 103 |
| — phlegmonous..... | 23 | Lympho-sarcoma..... | 105 |
| — productive..... | 59 | Lymph vessels, diseases of..... | 273 |
| — purulent..... | 58 | M | |
| — serous..... | 57 | Malformations, congenital..... | 305 |
| — specific..... | 59 | Malignant lymphoma..... | 103 |
| — treatment of..... | 62 | Malignant œdema..... | 21, 30, 34 |
| Inflammatory edema..... | 301 | — definition of..... | 34 |
| Inguinal hernia..... | 146 | — post-mortem changes of..... | 35 |
| Instruments..... | 41 | — symptoms of..... | 35 |
| Interstitial lymphadenitis..... | 278 | — termination of..... | 35 |
| — mammitis..... | 283 | — treatment of..... | 35 |
| — myositis..... | 244 | | |
| Intestinal calculi..... | 133 | | |

| | PAGE |
|---------------------------------|----------|
| Malignant tumors..... | 86 |
| Mammitis..... | 279-285 |
| — botryomycotic..... | 285 |
| — gangrenous..... | 283 |
| Massage..... | 66 |
| Mastitis..... | 279 |
| Melanotic sarcoma..... | 105, 107 |
| Metastatic abscess..... | 71 |
| — cellulitis..... | 24 |
| Mixed celled sarcoma..... | 105 |
| Moist gangrene..... | 81, 84 |
| Monarthrits..... | 196 |
| Monday morning disease..... | 27 |
| Monoplegia..... | 254 |
| Monorchids..... | 305 |
| Mortality in tetanus..... | 38 |
| Mucous membranes, diseases of.. | 300 |
| Mucous tissue..... | 96 |
| Mucous tumor..... | 96 |
| Multiple fracture..... | 154 |
| Muscles, rupture of..... | 52, 246 |
| — atrophy of..... | 248 |
| Muscular atrophy..... | 248, 250 |
| — rheumatism..... | 245 |
| — tumor..... | 99 |
| — wounds..... | 2, 19 |
| Mycofibroma..... | 91 |
| Myelinic nerve fibres..... | 100 |
| Myogenous contracture..... | 216 |
| Myoma..... | 99 |
| Myositis..... | 239 |
| — ossifying..... | 244 |
| — purulent..... | 242 |
| — rheumatic..... | 245 |
| Myxoma..... | 96 |

N

| | |
|--------------------------------|-------------|
| Necrosis..... | 27, 49, 186 |
| — of aponeuroses..... | 251 |
| Necrotic caries..... | 187 |
| — paralysis..... | 258 |
| — tumors..... | 100 |
| Neoformations, epithelial..... | 108 |
| Nerves, diseases of..... | 254 |

| | PAGE |
|------------------------------|------|
| Neuritis..... | 260 |
| Neurofibromata..... | 101 |
| Neurogenous contracture..... | 216 |
| Neuroma, false..... | 100 |
| Neuromata..... | 100 |

O

| | |
|-------------------------------|----------|
| Odontoma..... | 99 |
| Œdema bacillus..... | 34 |
| Open wounds..... | 1 |
| Opisthotonos..... | 37 |
| Orthotonos..... | 37 |
| Osseous tumor..... | 99 |
| Ossification of callus..... | 165 |
| Ossifying myositis..... | 244 |
| Osteitis..... | 178 |
| — causes of..... | 182 |
| — course of..... | 182 |
| — deforming..... | 184 |
| — fungous..... | 184 |
| — ossifying..... | 183 |
| — rarefying..... | 183 |
| Osteoclasts..... | 164 |
| Osteoma, dental..... | 99 |
| Osteomalacia..... | 192 |
| — causes of..... | 192 |
| — definition of..... | 192 |
| — symptoms of..... | 193 |
| — treatment of..... | 193 |
| Osteomyelitis..... | 178 |
| Osteophytes..... | 190 |
| Osteoporosis..... | 183, 193 |
| Osteosclerosis..... | 190 |
| Over-riding displacement..... | 155 |

P

| | |
|-------------------------|-----|
| Panneous arthritis..... | 201 |
| Papilloma..... | 115 |
| Paralysis..... | 254 |
| — facial..... | 259 |
| — nerve..... | 258 |
| — peripheral..... | 258 |
| — radial..... | 259 |
| — spinal..... | 258 |

| | PAGE | | PAGE |
|---------------------------------|----------|------------------------------------|---------|
| Parasitic infection..... | 112 | Purulent bursitis | 237 |
| Parenchymatous hemorrhage.... | 3 | — fistula | 78 |
| — lymphadenitis..... | 277 | — infiltration..... | 58 |
| Paresis | 254 | — inflammation | 58 |
| Pelvic hernia..... | 146 | — lymphadenitis..... | 278 |
| Pentastomum taenoides..... | 140 | — myositis..... | 242 |
| Periarthritis..... | 196, 205 | — tendovaginitis | 232 |
| Periarticular ringbone..... | 205 | Pus, constituents of | 22 |
| Perilymphadenitis..... | 277 | — ichorous | 22 |
| Periostitis..... | 179 | — sanious | 22 |
| — acute aseptic | 179 | Putrid gangrene | 81 |
| — acute purulent.... | 181 | Pyemia..... | 21, 32 |
| — chronic fibrous | 182 | Pyemic arthritis | 203 |
| — chronic purulent..... | 181 | | |
| Peripheral paralysis..... | 258 | | |
| Permanent callus | 163 | R | |
| Persistence of the urachus..... | 306 | Rabies | 38 |
| Phagedenic gangrene | 81 | Rachitis, causes of..... | 191 |
| — ulcer | 77 | — characteristics of..... | 191 |
| Phimosis | 305 | — symptoms of | 192 |
| Phlebitis | 270 | — treatment of..... | 192 |
| Phlegmonous inflammation..... | 23 | Radial paralysis | 259 |
| Phlogosia | 57 | Reaction of degeneration.... | 256 |
| Pleurosthotonos | 37 | Reduction of fractures..... | 167 |
| Pododermatitis..... | 299 | Regeneration of blood..... | 8 |
| Poisoned wounds..... | 7 | Regeneration of tissue..... | 19 |
| Polyarthrititis | 196 | Renal calculi..... | 132 |
| Polypus | 91 | Retention cyst..... | 120 |
| Preputial calculi | 134 | Retraction of tibial aponeurosis.. | 253 |
| Priessnitz fomentations..... | 65 | Rheumatic myositis..... | 245 |
| Prolapsus | 147 | Rheumatism, articular..... | 202 |
| — of the bulb of the eye..... | 150 | Rice kernel bodies..... | 134 |
| — of the intestines..... | 149 | Rickets | 191 |
| — of the omentum | 149 | Ringbone, periarticular | 205 |
| — of the penis | 150 | Rotary displacement | 155 |
| — of the rectum..... | 149 | Round-celled sarcoma..... | 105 |
| — of the tongue | 150 | Rubor | 59 |
| — of the uterus | 150 | Rupture of aponeuroses..... | 253 |
| — of the vagina..... | 150 | — of arteries..... | 268 |
| Prophylaxy of tetanus | 37 | — of muscles..... | 52, 246 |
| Provisional callus..... | 163 | — of tendons..... | 53, 225 |
| Pseudoarthrosis | 164 | | |
| Punctured wounds..... | 5 | S | |
| Purulent arthritis..... | 198 | Sacculated aneurism | 264 |

| | PAGE | | PAGE |
|---------------------------|------------|-------------------------------|------|
| Wounds | 1 | Wounds, hemorrhages in..... | 2 |
| — bony..... | 2 | — incised..... | 5 |
| — classification of | 1 | — influence on health of..... | 3 |
| — contused..... | 6 | — lacerated. | 5 |
| — definition of | 1 | — open..... | 1 |
| — description of..... | 4 | — pain in | 2 |
| — fever in..... | 4 | — poisoned..... | 6 |
| — gaping of | 3 | — punctured | 5 |
| — gunshot..... | 6 | — subcutaneous'..... | 2 |
| — healing of..... | 13, 17, 19 | — symptoms of.... | 1 |

LIBRARY OF CONGRESS



0 002 993 864 7